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Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

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V. A. Kolemayev *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 133–141 refs (See N64-12451 04-01) OTS: $5.00

An abstract model of statistical control for manufacturing processes is investigated for the purpose of obtaining a maximum net profit, that is, profit from the year's production minus expenses of control [or administration]. Author

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2. RADICALS—PRODUCTS OF THE THERMAL DECOMPOSITION OF SUBSTITUTED CYCLOHEXADIENEONE PEROXIDE V. D. Pokhodenko and L. N. Ganyuk p 8–11 refs (See N64-12495 04-07)

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5. LUMINESCENT ANALYSIS OF LACUSTRINE DETRITUS A. G. Rodina p 25–30 refs (See N64-12498 04-16)

6. THE MECHANISM OF THE BIOLOGICAL ACTION OF A PULSED MAGNETIC FIELD N. A. Solov'yev p 31–35 (See N64-12499 04-16)

N64-12501 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS FROM GEOMAGNETIZM I AERONOMIYA [MOSCOW, V. 3] NO. 1, 1963
Ya. L. Al'pert 7 May 1963 53 p refs Transl. into ENGLISH of 2 articles p 10–24 and 157–170
(JPRS-19069; OTS-63-21757) OTS: $1.50

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1. RADIO INVESTIGATIONS OF THE STRUCTURE OF THE IONOSPHERE BY MEANS OF KOSMOS ARTIFICIAL EARTH SATELLITES AT COHERENT FREQUENCIES; PRELIMINARY RESULTS Ya. L. Al'pert, V. B. Belyanskiy, and N. A. Mityakov p 1–27 refs (See N64-12502 04-12)

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N64-12507 Joint Publications Research Service, Washington, D.C.
BIOLOGICAL ASPECTS OF CYBERNETICS
A. M. Kuzin, ed. 11 Jun. 1963 352 p refs Transl. into ENGLISH of the book "Biologicheskiye aspekty kibernetiki—Sbornik rabot" Moscow, Izd. AN SSSR, 1962 p 1-239 refs
(JPRS-19637; OTS-63-31024) OTS: $5.00

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N64-12531* Oak Ridge National Lab., Tenn.

NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT For Period Ending 1 Aug. 1963

E. P. Blizard et al 18 Dec. 1963 151 p refs Chapters 8, 9, and 10 of the Neutron Physics Div. Report on High-Energy Radiation Shielding Rer Program.

(NASA Orders T-7632 and R-104; Contract W-7405-ENG-26) (ORNL-3499, Vol. 2) OTS: $2.75

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19. ABSORBED DOSE IN A WATER-FILLED SPHERICAL PHANTOM DUE TO 14-Mev AND Po-Be NEUTRONS T. V. Blosser and R. M. Freestone, Jr. p 85–88 refs (See N64-12547 04-23)

20. NEUTRON AND PROTON SPECTRA FROM TARGETS BOMBARDED BY 160-Mev PROTONS J. W. Wachter, W. A. Gibson, W. R. Burrus, and C. F. Johnson p 89–93 refs (See N64-12548 04-23)

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23. MEASUREMENTS OF THE INTENSITY OF THE PROTON BEAM OF THE HARVARD UNIVERSITY SYNCHROCYCLOTRON FOR ENERGY-SPECTRAL MEASUREMENTS OF NUCLEAR SECONDARIES R. T. Santoro and R. W. Peelle p 100–104 refs (See N64-12551 04-23)

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28. SOME RECENT APPLICATIONS OF THE SLOP CODE FOR UNFOLDING INSTRUMENT RESPONSE W. R. Burrus p 120–124 refs (See N64-12556 04-23)

29. A CALCULATION OF THE PULSE-HEIGHT RESPONSE OF SCINTILLATORS TO HIGH-ENERGY ELECTRONS, POSITRONS, OR PHOTONS C. D. Zerby and H. S. Moran p 124–126 refs (See N64-12557 04-23)

30. PERFORMANCE CHARACTERISTICS OF MODULAR NANOSECOND CIRCUITRY EMPLOYING TUNNEL DIODES N. W. Hill, R. J. Scroggs, and J. M. Madison p 127–140 refs (See N64-12558 04-09)

N64-12620 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NEW WEAPON "X" – BALL SHAPED THUNDERS (GLOBULAR FIREBALLS)

Jerzy R. Konieczny 3 Oct. 1963 7 p Transl. into ENGLISH of an article from Wojskowy Przeglad Lotniczy (Warsaw), no. 2, 1963 p 72–75

(FTD-TT-63-806/1+2; AD-423834)

Recent investigations in the field of plasma physics indicate that the time is close when it will be possible to produce artificial spherical thunders and to use them as defensive and offensive weapons. These thunders (called globular fireballs) are thought to originate in the atmosphere after strong electric discharges. Tests are being conducted in an effort to produce these fireballs and to utilize them as an antimissile defense. C.L.W.

N64-12637 Hughes Aircraft Co., Culver City, Calif.

ELECTRICAL AND ELECTRONIC PROPERTIES OF MATERIALS INFORMATION RETRIEVAL PROGRAM [Final Report No. 2, Jun. 15-Dec. 14, 1962]

H. Thayne Johnson, Donald L. Grigsby, and Dana H. Johnson Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Oct. 1963 127 p refs

(Contract AF 33(616)-8438)

(ASD-TDR-62-539, Pt. II; AD-407550)

A documentation system has been established for abstracting, indexing, and retrieving data relative to the electrical and electronic properties of materials. That data and the literature are retrieved through a modified manual coordinate index highly adaptable to machine usage. Publications include data sheets, thesauri, property tables, and summary reviews. Included are a consolidated list of electrical and electronic properties and lists in the following categories of materials: electroluminescent materials, thermionic emitters, ferroelectrics, ferrites, ferromagnetics, superconductors and metals. Author

N64-12639 Minneapolis-Honeywell Regulator Co., West Covina, Calif.

GROUND RESOLUTION STUDY FINAL REPORT

Luther B. Jennings, Frederick B. Meeker, Gerald A. Praver, and Robert N. Cook 29 Nov. 1963 260 p

(Contract AF 30(602)-2653)

(RADC-TDR-63-224; AD-425676)

The ground resolution study was undertaken for the purpose of analyzing photo interpreter performance as a function of image quality. The study dealt mainly with the responses of student photo interpreters: their performance was measured in terms of accuracy, speed of response, and features used in identification. Twenty-nine types of tactical targets, including aircraft, vehicles, weapons, and manmade structures, were investigated. All responses were made against a background of systematically controlled levels of ground resolution and contrast ratio. Eighteen unique combinations of ground resolution and contrast ratio were employed, with ground resolution ranging from 1 to 64 feet in six logarithmic steps and contrast ratio ranging from 1:1 to 15:1 in three logarithmic steps. In addition, simulated aerial photography was used to establish the correspondence between photographs of real and simulated targets. Author

N64-12655 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.

THE APPLICATION OF SAMPLED-DATA CONTROL TO AN ANTI-TANK MISSILE

Gordon D. Welford and William W. Malcolm 8 Oct. 1963 84 p refs

(RG-TR-63-21; AD-423152)

The feasibility of a sampled-data control system for a close support missile, such as the antitank missile, is studied primarily from the standpoint of performance. Realistic requirements which reflect the limitations of available hardware are placed on the system. Airframe inertia and inertia changes are characteristic of a hypervelocity antitank missile which is under preliminary development. A comparison is made between the continuous-data system and the sampled-data system, which are designed to meet the same requirements. The study is made through mathematical analysis aided by analog computer simulation. Author

N64-12656 Naval Ordnance Lab., White Oak, Md.

DEVELOPMENT OF A PLASTICS CHARGE CASE FOR THE 7.2 PROJECTOR CHARGE ANTI-SUBMARINE WEAPON

M. A. Kinna and S. P. Prosen 18 Jun. 1963 41 p

(NOLTR-63-148; AD-424913)

This report contains data and test results on the development of a high density polyethylene charge case as a replacement for the metal case which has been used since inception of the 7.2 Projector Charge Anti-Submarine Weapon. Several materials and case designs which were investigated are discussed relative to their performance characteristics. The results of this study show that the range of the weapon is increased by approximately 15 meters when the high density polyethylene case is used. In addition, the case is less susceptible to water leakage during storage, is not affected by salt water corrosion, and can be produced more economically than all-metal cases. Finally, the hazard to personnel in the area of the projector mounts has been markedly reduced. Author

N64-12698 Joint Publications Research Service, Washington, D.C.

FOREIGN DEVELOPMENTS IN MACHINE TRANSLATION AND INFORMATION PROCESSING, NO. 147

V. T. Aleksanyan et al 23 Dec. 1963 84 p refs Transl. from Russian into ENGLISH

(JPRS-22415; OTS-64-21096) OTS: $2.25

CONTENTS:

1. A CHEMICAL CODE FOR SEARCHING SPECTROCHEMICAL INFORMATION V. T. Aleksanyan, Z. B. Barinova, G. E. Vleduts, and L. A. Shevyakova p 1–12 refs (See N64-12699 04-07)

2. CERTAIN QUESTIONS IN A THEORY OF TRANSLATION ASSOCIATED WITH THE OVERALL PROBLEM OF AUTOMATING INFORMATION PROCESSES I. I. Kevzin and V. Yu. Rozentsveyg p 13–34 refs (See N64-12700 04-01)

3. CERTAIN PROBLEMS IN AUTOMATIC SYNTACTIC ANALYSIS OF A CZECH SCIENTIFIC-TECHNICAL TEXT N.A. Pashchenko p 35–58

4. CHRONICLE p 59–61

5. SOME CHARACTERISTICS OF CORRECT SYNTACTIC STRUCTURE L. N. Iordanskaya p 62–81 refs

N64-12700 Joint Publications Research Service, Washington, D.C.

CERTAIN QUESTIONS IN A THEORY OF TRANSLATION ASSOCIATED WITH THE OVERALL PROBLEM OF AUTOMATING INFORMATION PROCESSES

I. I. Revzin and V. Yu. Rozentsveyg *In its* Foreign Develop. in Machine Transl. and Inform. Process., no. 147 23 Dec. 1963 p 13–34 refs (See N64-12698 04-01) OTS: $2.25

The problem of automating the translation process reduces to a clarification of whether there exists a permanent given boundary between translation and interpretation. Since translation presupposes the retention of the invariance of meaning, a semantic classification of the language categories is necessary. As a first approximation, the authors propose to differentiate semantically full categories containing extralinguistic information, from semantically empty categories which are used only for the internal needs of a language. The article presents a general outline of semantically full categories, and it is shown that their detailed study reveals the translation process as consisting of a simple recoding [when the lexical and grammatical categories of the source language and the target language coincide], and of a grammatical and lexical transformation within each of the two languages [when there is no such coincidence]. Author

N64-12722 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM DOKLADY AKADEMII NAUK SSSR (REPORTS OF THE ACADEMY OF SCIENCES SSSR) [MOSCOW, VOLUME 149] No. 1, 1963

12 Jul. 1963 36 p refs Transl. into ENGLISH of selected articles, p 142–145, 185–188, 194–201, 205–206 and 213–216

(JPRS-20153; OTS-63-31273) OTS: $1.00

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1. EPR STUDY OF SENSITIZATION OF THE ALCOHOL DEHYDRATION PHOTO-REACTION AT 77° K V. Ye. Kholmogorov, E. V. Baranov, and A. N. Terenin p 1–7 refs (See N64-12723 04-07)

2. NUCLEAR DIVISION AND DNA SYNTHESIS DURING THE COURSE OF DEVELOPMENT OF SOMATIC MUSCULATURE L. Zhinkin and L. Andreyeva p 8–13 refs

3. INCIDENCE OF LEUKOSIS AFTER SINGLE AND FRACTIONATED IRRADIATION S. N. Aleksandrov and K. F. Galkovskaya p 14–18 refs (See N64-12724 04-16)

4. COMPARATIVE STUDY OF THE NUCLEOTIDE COMPOSITION OF MICROSOMAL AND SOLUBLE RNA'S OF INSECTS N. A. Gumilevskaya and I. M. Sisakyan p 19–24 refs

5. THE EFFECT OF TISSUE EXTRACT ON THE LENS-REGENERATING POWER OF THE IRIS IN RANA RIDIBUNDA TADPOLES I. Korkia p 26–27 refs

6. THE EFFECT OF D-C POLES ON ULTRABOUNDARY INHIBITION N. P. Movchan p 29–33 refs

N64-12726 Joint Publications Research Service, Washington, D.C.

NEWS OF HIGHER EDUCATIONAL INSTITUTIONS, MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION, USSR, RADIO ENGINEERING SERIES

N. S. Neyman et al 4 Dec. 1963 279 p refs Transl. into ENGLISH of Izv. Vysshikh. Uchebn. Zavedenii, Radiotekhn. (Kiev), v. 6, no. 3, May–Jun. 1963 p 217–324

(JPRS-22132; OTS-63-41289) OTS: $4.00

CONTENTS:

1. SIMILARITY OF VACUUM ELECTRONIC SYSTEMS N. S. Neyman p 1–27 refs (See N64-12727 04-09)

2. CONCERNING THE PROPAGATION OF RADIO WAVES ALONG THE INHOMOGENEOUS EARTH'S SURFACE A. N. Plemyannikov p 28–47 ref (See N64-12728 04-08)

3. ANALYSIS OF OPERATION OF CAPACITIVE PARAMETRON G. I. Rassokhin p 48–74 refs (See N64-12729 04-09)

4. DESIGN AND CALCULATION OF INDUCTIVE PARAMETRONS V. A. Soklov p 75–97 refs (See N64-12730 04-09)

5. RECIPROCAL FERRITE SWITCH BASED ON A SLOT BRIDGE V. S. Averbakh and Yu. M. Zhidko p 98–113 refs (See N64-12731 04-09)

6. MODEL OF DIFFUSION TRANSISTOR V. V. Galitskiy p 114–127 refs (See N64-12732 04-09)

7. METHOD OF SYNTHESIS OF FREQUENCY AND TRANSFER CHARACTERISTICS OF A TWO-PORT NETWORK Yu. G. Kuleshov p 128–143 refs (See N64-12733 04-09)

8. MUTUAL SYNCHRONIZATION OF SELF-OSCILLATING, WITH A MULTIPLE RATIO OF OSCILLATION FREQUENCIES V. P. Rubanik p 144–154 refs (See N64-12734 04-09)

9. METHOD OF MEASURING THE NEGATIVE RESISTANCE OF TUNNEL DIODES I. I. Shagurin p 155–164 refs (See N64-12735 04-09)

10. CHOICE OF OPTIMAL CONSUMPTION OF ELECTRIC POWER IN ELEMENTS OF RADIO APPARATUS N. F. Vollerner p 165–176 refs (See N64-12736 04-09)

11. ELECTRONIC FILTER WITH PARALLEL TUBE Ya. I. Tetel'baum p 177–201 refs (See N64-21737 04-09)

12. FREQUENCY CHARACTERISTICS OF A SYSTEM OF TWO COUPLED CIRCUITS WITH VARIABLE CAPACITANCE IN ONE OF THE CIRCUITS L. A. Smirnova, and N. V. Soina p 202–206 refs (See N64-12738 04-09)

13. DYNAMIC CHARACTERISTICS OF A CIRCUIT WITH VARIABLE CAPACITANCE AT LOW REGENERATION LEVEL Ye. M. Gershenzon, T. F. Lyubimova, G. I. Rozhkova, and V. S. Etkin p 207–211 refs (See N64-12739 04-09)

14. ON THE THEORY OF APPROXIMATION OF TWO CHARACTERISTICS AT LARGE VOLTAGE AMPLITUDES M. I. Khodzishskiy p 212–223 refs (See N64-12740 04-09)

15. AUTOMATIC OPTIMIZATION OF CHARACTERISTICS OF A FERRITE SWITCH V. V. Koshelev, and V. I. Talanov p 224–233 refs (See N64-12741 04-09)

16. METHOD FOR IMPROVING THE REAL SELECTIVITY OF AM RECEIVERS V. M. Shushin and A. P. Zelenin p 234–240 refs (See N64-12742 04-08)

17. CONVERSION OF FREQUENCY MODULATED OSCILLATIONS INTO AMPLITUDE-FREQUENCY-MODULATED OSCILLATIONS BY A DIFFERENTIATING DEVICE L. Ya. Il'nitskiy p 241–246 refs (See N64-12743 04-09)

18. FORMATION OF MULTI-LOBE DIRECTIVITY PATTERNS WITH THE AID OF MODULATED SLOW-WAVE STRUCTURES A. I. Gudzenko p 247–251 refs (See N64-12744 04-08)

19. ON THE OPTIMALITY OF STEP-TYPE CHEBYSHEV TRANSFORMERS G. P. Veselkov p 252–259 refs (See N64-12745 04-09)

20. FIRST APPLICATIONS OF RADIO IN GEODETIC WORK BEYOND THE POLAR CIRCLE, 1922–1924 B. A. Ostroumov p 260–269 (See N64-12746 04-08)

21. DISSERTATIONS FOR THE DEGREE OF CANDIDATE OF SCIENCE I. N. Pustynskiy p 270–274

N64-12773 Joint Publications Research Service, Washington, D.C.

STRUCTURAL DEFECTS OF GERMANIUM AND HIGH-TEMPERATURE LABORATORY FURNACE

24 Dec. 1963 16 p refs Transl. into ENGLISH of 2 articles from Zavodsk. Lab. (Moscow), no. 10, 1963 p 1206–1211 and 1258–1259
(JPRS-22442; OTS-64-21111) OTS: $0.50

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1. PRESENTATION OF RESULTS OF INVESTIGATIONS OF STRUCTURAL DEFECTS OF GERMANIUM V. N. Maslov, L. V. Nabatova, V. V. Nalimov, I. N. Nyuberg, A. V. Ovodova et al p 1–10 refs (See N64-12774 04-23)

2. MODIFIED TVV-TYPE FURNACE WITH TUNGSTEN HEATING ELEMENTS FOR INVESTIGATIONS AT TEMPERATURES UP TO 2800° C V. Ya. Chekhovskoy and A. Ye. Sheyndlin p 11–13 refs (See N64-12775 04-10)

N64-12798 Joint Publications Research Service, Washington, D.C.

DUST NATURE OF THE LUNAR SURFACE AND DETERMINING FIGURE OF THE EARTH THROUGH GRAVITY ANOMALIES

N. S. Orlova et al 15 Jul. 1963 22 p refs Transl. into ENGLISH of 2 articles from Tr. Astron. Observ. (Leningrad), no. 307, 1962 p 179–186 and 234–242
(JPRS-20167; OTS-63-31282) OTS: $0.75

CONTENTS:

1. SLOPE ANGLES OF LOOSE MATERIALS AND HYPOTHESES OF THE DUST NATURE OF THE LUNAR SURFACE N. S. Orlova p 1–9 refs (See N64-12799 04-29)

2. DETERMINATION OF THE FIGURE OF THE EARTH THROUGH ANOMALIES OF THE VERTICAL GRADIENT OF GRAVITY S. V. Gromov p 10–19 ref (See N64-12800 04-12)

N64-12820 Stanford U., Calif. Inst. for Mathematical Studies in the Social Sciences

BALANCED GROWTH UNDER EXOGENOUS LABOR GROWTH

Yasusuke Murakami 8 Nov. 1963 55 p
(Contract Nonr-225(50))
(Tech. Rept. 126; AD-424941)

An attempt was made to establish some link between the von Neumann-type analysis and the Harrod-type analysis, and to fill a gap in the theory of economic growth. The models used are introduced, and the arguments are presented in two stages—first in a simple model and then in a generalized model. The problem of the existence and uniqueness of a balanced growth path in a simple model was investigated, and several statements are presented concerning the relative stability of a balanced growth path in a simple model. The statements are then generalized, and special attention is given to the efficiency of a balanced growth path. C.L.W.

N64-12889 Joint Publications Research Service, Washington, D.C.

OUTER SPACE EXPLORATIONS

A. A. Blagonravov et al 4 Dec. 1963 44 p refs Transl. into ENGLISH of 2 articles from Vestn. Akad. Nauk SSSR (Moscow), v. 33, no. 9, Sep. 1963 p 9–22
(JPRS-22139; OTS-63-41293) OTS: $1.25

CONTENTS:

1. EXPLORATIONS OF OUTER SPACE AND THE OUTER LAYERS OF THE ATMOSPHERE A. A. Blagonravov p 1–22 (See N64-12890 04-29)

2. FLIGHTS OF SPACE VEHICLES VOSTOK-5 AND VOSTOK-6 V. I. Yazdovskiy and V. G. Denisov p 23–41 (See N64-12891 04-32)

N64-12892 Joint Publications Research Service, Washington, D.C.

DEVELOPMENTS IN USSR POWDER METALLURGY

I. M. Fedorchenko et al 22 Jul. 1963 42 p refs Transl. into ENGLISH of 3 articles from Poroshkovaya Met., Akad. Nauk Ukr. SSR, (Kiev), no. 1, Jan.–Feb. 1963 p 3–12 and 93–111
(JPRS-20277; OTS-63-31343) OTS: $1.25

CONTENTS:

1. POSSIBILITIES AND PROBLEMS OF POWDER METALLURGY IN THE DEVELOPMENT OF NEW MATERIALS I. M. Fedorchenko p 1–14 refs (See N64-12893 04-18)

2. NEW DESIGNS FOR REDUCTION FURNACES IN THE PRODUCTION OF HARD ALLOYS V. N. Mel'nikov, V. A. Vesnina, G. L. Fridman, and V. V. Yakovlev p 15–29 refs (See N64-12894 04-17)

3. A PROGRESSIVE METHOD OF PRODUCING GEAR WHEELS V. A. Krokha and A. M. Bakhovkin p 30–39 refs

N64-13069 Southampton U. (Gt. Brit.)

WALL PRESSURE FLUCTUATIONS IN BOUNDARY LAYER FLOW AND RESPONSE OF SIMPLE STRUCTURES TO RANDOM PRESSURE FIELDS Final Report

M. K. Bull, J. F. Wilby, and D. R. Blackman Jul. 1963 286 p refs
(Contract AF 61(052)-358)
(AASU-243; AD-284433)

CONTENTS:

1. PART 1: WALL PRESSURE FLUCTUATIONS ASSOCIATED WITH SUBSONIC TURBULENT BOUNDARY LAYER FLOW 148 p refs (See N64-13070 04-02)

2. PART 2: RESPONSE OF PANELS TO RANDOM PRESSURE FIELDS 80 p refs (See N64-13071 04-33)

3. PART 3: BOUNDARY LAYER PRESSURE FLUCTUATIONS IN THE LAMINAR-TURBULENT TRANSITION REGION 47 p refs

N64-13166 Los Alamos Scientific Lab., N. Mex.

IMPACT AND THERMAL TESTS ON TRANSPORT CONTAINERS ICC 2-R AND ICC 6-J

Horace E. Noyes 16 Dec. 1963 15 p
(Contract W-7405-eng-36)
(LAMS-2983) OTS: $0.50

A series of drop and fire tests were conducted on a unit that consisted of an internal container for nuclear material (ICC 2-R) and an external container (ICC 6-J) in the form of a steel drum. Results of the tests proved conclusively the integrity of the combined ICC 2-R and 6-J for impact and thermal safety. R.T.K.

N64-13195 Federal Aviation Agency, Washington, D.C. ATC Development Div.
MEASUREMENT OF THE NATIONAL AIRSPACE SYSTEM Memorandum Report
Jan. 1963 63 p refs

This report contains a limited description of the present FAA system for measurement of the National Airspace System. It suggests that measures of operational effectiveness be added to the present system to provide inputs for cost/benefit studies and to assist top management in decision-making functions. Author

N64-13262* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-23, VOLUME 4, FOR THE PERIOD AUGUST 1, 1963 TO SEPTEMBER 30, 1963. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Oct. 1963 327 p refs
(NASA Contract NAS7-100)
(NASA CR-53001; JPL-SPS-37-23, Vol. 4) OTS: $19.75 ph, $10.01 mf

Related supporting research and advanced development projects for space-exploration programs are reported. Areas included were systems analysis of orbital maneuvers; guidance and control; engineering mechanics; engineering facilities; propulsion; telecommunications; and space science. C.L.W.

N64-13289 Associated Universities, Inc., New York, N.Y.
BROOKHAVEN NATIONAL LABORATORY ANNUAL REPORT, JULY 1, 1963
[1963] 209 p refs
Contract AT(30-2)-GEN-16)
(BNL-806-(AS-17)) OTS: $3.00

Brief summaries of nuclear research programs in the physical and biological sciences and in engineering are presented, together with a description of the facilities, operations, services, and administration of the Brookhaven National Laboratory. Since the details of many of the research and development programs reported are available in periodicals and special reports, a bibliography of material published or submitted for publication during the year is included. M.P.G.

N64-13296 National Aeronautics and Space Administration, Washington, D.C.
OFFICE OF APPLICATIONS ACTING DIRECTOR TELLS FUTURE PLANS
Leonard Jaffe Repr. from Data, Apr. 1963 p 37–42

The transcript is presented of an interview in which Leonard Jaffe, Director, Communications Systems, Office of Applications, NASA, discussed topics which include the following: (1) mission and objectives of the Office of Applications; (2) the meaning of the 1964 budget request; (3) the TIROS program; (4) Nimbus, Aeros, Relay, and Syncom satellites; (5) the Gemini flights; (6) the worldwide communications satellite program; (7) multipurpose sounding rockets for meteorological research; (8) the allocation of the funds from the Office of Applications; and (9) the economic implications of the research and development programs of the Office of Applications. R.T.K.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-12418 Hughes Aircraft Co., Culver City, Calif.
THE ATTENUATION OF SHOCKS IN CONSTRICTED CHANNELS
Hyman Serbin *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 188–193 refs (See N64-12407 04-01)

The propagation of shock waves in ducts of varying cross section has been studied for the limiting cases of (1) a weak shock wave and (2) slowly varying cross-section area. The case of a shock of finite strength impinging on an abrupt change in cross-section area is a complex phenomenon requiring a nonlinear analysis. On the other hand, it is reasonable to expect that at large distances from the constriction, in those parts of the channel where the cross section is almost constant, the standard shock equations derived from steady flow will apply. If, in addition, it is assumed that the flow is one-dimensional (so that the shocks are normal to the axis of the channel), then it is possible to derive flow patterns which are physically compatible with the environment imposed by an incident shock. Author

N64-12484 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF FLOW PAST BODIES OF REVOLUTION AT SUPERSONIC SPEED
P. I. Chushkin *In its* J. of Computer Math. and Mathematical Phys., Selected Articles 20 May 1963 p 18–55 refs (See N64-12482 04-01) OTS: $7.60

Numerical methods involving the use of electronic computers provided an effective solution, over the entire flow region, for the problem of the hypersonic flow of a stream of ideal or real gas past blunt bodies of a given shape. The theory based on the unsteady-flow analogy made it possible to determine the shape of the shock wave and the pressure distribution on a blunt cylinder and a very slender blunt cone. There were no exact analytic and numerical solutions found for the equivalent unsteady-flow problem (except for the case of a detonation). Approximate solutions are proposed that are based on additional assumptions, and are generally applicable only for an ideal gas. R.T.K.

N64-12707 Army Missile Command, Huntsville, Ala. Advanced Systems Lab.
THE EFFECTS OF BASE BLEED AND SUSTAINER ROCKET NOZZLE DIAMETER AND LOCATION ON THE BASE DRAG OF A BODY OF REVOLUTION WITH CONCENTRIC BOOST AND SUSTAINER ROCKET NOZZLES
Charles E. Brazzel 15 Jul. 1963 37 p refs
(RF-TR-63-23; AD-423963)

A concentric arrangement of boost and sustainer rocket nozzles has been investigated to determine the effects of base bleed and the effects of sustainer nozzle diameter and relative longitudinal position on the base drag of the body during sustainer operation. The results of the investigation indicate that the jet-on base drag of a body can be significantly reduced by the use of base bleed and nozzle arrangement, and that the jet-on base drag is a function of the jet thrust. Author

N64-12850 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CERTAIN APPROXIMATE SOLUTIONS FOR THE PROBLEM OF DIRECTING A HYPERSONIC GAS FLOW AROUND THIN BODIES

A. M. Antonov and M. M. Sidlyar 10 Oct. 1963 12 p refs Transl. into ENGLISH of an article from Prik. Mekh. (Ukr.), v. 7, no. 6, 1961 p 649–655

(FTD-TT-63-899/1+2; AD-425658)

Equations are derived to describe the gas flow around thin bodies under conditions when there is no ionization or dissociation of the gas, and when the Mach number for the wedge and cone does not exceed 16 to 20. R.T.K.

N64-13046 McGill U., Montreal (Canada) Mechanical Engineering Research Lab.

THE FLOW INDUCED BY TWO-DIMENSIONAL AND AXISYMMETRIC TURBULENT JETS ISSUING NORMALLY TO AN INFINITE PLANE SURFACE

I. Wyganski Dec. 1963 13 p refs

(DRB Grant 9551-12)

(Rept. 63-12)

The jet flow was analyzed by expanding Taylor's approach for isothermal jets in order to predict the detailed pressure distribution on the flat surface from which the jet was ejected. This pressure was compared with new experimental data for two-dimensional and axisymmetric, incompressible, isothermal jets, and the agreement was good in both cases. In addition, the following observations were made: (1) The reduction of pressure associated with jet entrainment, in the two-dimensional case, was significant several hundred slot widths away from the blowing slot, whereas in the axisymmetric case, this reduction of pressure was smaller, and became very small within a few nozzle diameters. (2) A discontinuity in the inflow velocity occurred at the end of the mixing region, since both the mixing region and the fully developed jet were analyzed individually. (3) The flow induced by the jet became independent of the slot width or nozzle diameter at a distance far away from the nozzle. Also, other approximate methods for accounting for the existence of a finite slot are discussed. I.v.L.

N64-13070 Southampton U. (Gt. Brit.)

PART I: WALL PRESSURE FLUCTUATIONS ASSOCIATED WITH SUBSONIC TURBULENT BOUNDARY LAYER FLOW

In its Wall Pressure Fluctuations in Boundary Layer Flow and Response of Simple Struct. to Random Pressure Fields Jul. 1963 148 p refs (See N64-13069 04-01)

Experimental data on various statistical properties of the fluctuating wall pressure field, associated with a subsonic turbulent boundary layer, are presented and discussed. The boundary layer investigated was that developed, after natural transition from laminar to turbulent flow, on the wall of a wind tunnel designed and built especially for this investigation. The statistical quantities of the wall pressure field investigated were root mean square pressure, frequency power spectrum and space-time correlations. Measurements were also made of correlations between the wall pressure fluctuations and the streamwise component of velocity fluctuation in the boundary layer. Theoretical expressions for pressure fluctuations, in terms of velocity fluctuations, are given, and possible forms of similarity for the wall pressure field are discussed. It was concluded that the field is not likely to have a self-preserving form. The main conclusion to which the measurements lead is that the wall pressure field has a complex nature consistent with the idea that it receives contributions from pressure sources in the boundary layer with a wide range of convective velocities and comprises two families of convective wave number components. I.v.L.

N64-13188* Alabama U. Research Inst., Huntsville

NON-EQUILIBRIUM HYPERSONIC FLOW OF AIR IN HYPERSONIC NOZZLES AND AROUND BLUNT BODIES Research Report No. 5

Janardanarao Yalamanchili, Rudolph Hermann, and Jurgen Thoenes Aug. 1963 19 p Presented at the 5th Intern. Symp. on Space Technol. and Sci., Tokyo, 2–7 Sep. 1963 Condensed Version of UARI Res. Rept. No. 3

(NASA Grant NsG-381; Contract DA-01-009-AMC-18(Z))

(NASA CR-55139) OTS: $1.60 ph, $0.80 mf

Nonequilibrium hypersonic nozzle flow of air is investigated for supply temperatures of 4000° to 6000° K, supply pressures of 10 to 100 atm, and for nozzle area ratios of 1 to 10,000. The direct method is used for the first time to calculate the nonequilibrium hypersonic flow of air around blunt bodies. Results are given for the flow around a circular cylinder. Author

N64-13232 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

INTERNAL AERODYNAMIC PROBLEMS OF THE "MACH 2" SUPERSONIC TRANSPORT AEROPLANE [PROBLEMES D'AERODYNAMIQUE INTERNE POSES PAR L'AVION DE TRANSPORT SUPERSONIQUE "MACH 2"]

J. Leynaert and J-M. Brasseur London, Min. of Aviation, Sep. 1963 17 p refs Transl. into ENGLISH of an article from Rech. Aeron. (Chatillon-sous-Bagneux), no. 91, Nov.–Dec. 1962 p 15–22 Presented at the 5th European Aeron. Congr., Venice, 12–15 Sep. 1962 (See N63-12483 06-02)

(RAE-Trans-1043)

This paper presents results of preliminary studies of engine intakes and nozzles considered for a projected supersonic transport aeroplane in the Mach 2 class. Experimental results obtained with a two-dimensional intake demonstrate the factors involved in choosing between external and internal supersonic compression. The methods of calculation used for studying various flow-mixing processes at the engine exhaust regions are presented, and some theoretical results are compared with experimental data. Author

N64-13270* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

OPTICAL FREE-FLIGHT WAKE STUDIES

Bain Dayman, Jr. 1 Nov. 1962 29 p refs

(NASA Contract NAS7-100)

(NASA CR-53014; JPL-TR-32-364) OTS: $2.60 ph, $1.07 mf

In conjunction with the extensive effort being put into the determination of wake properties, a program has been initiated in the supersonic and hypersonic wind tunnels to obtain spark Schlieren photographs of the separation and near-wake regions of various free-flight (no support interference) bodies. For the most part, the models investigated were of two types, spheres and 30° included-angle cones. Author

N64-13359 Aeronautical Research Council (Gt. Brit.)
PRESSURE DISTRIBUTIONS AND FLOW PATTERNS ON SOME CONICAL SHAPES WITH SHARP EDGES AND SYMMETRICAL CROSS-SECTIONS AT M = 4.0
L. C. Squire London, HMSO, 1963 40 p refs
(ARC-R&M-3340; supersedes RAE-TN-AERO-2823, ARC-24188) Available from HMSO: 15s 6d

Results are given of a wind-tunnel program made to study the pressure distributions and flow patterns over a series of simple, conical shapes at a Mach number of 4.0. The results have been compared with various approximate theories and the limitations of these theories are discussed. It is found that at this Mach number leading-edge separations still have an influence on the suction-surface pressure, and that this surface still makes a significant contribution to the overall forces. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-12485 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NUMERICAL SOLUTION FOR THE PROBLEM OF THE FLOW OF A SUPERSONIC STREAM PAST THE UPPER SURFACE OF A TRIANGULAR WING
D. A. Babayev *In its* J. of Computer Math. and Mathematical Phys., Selected Articles 20 May 1963 p 56–73 refs (See N64-12482 04-01) OTS: $7.60

A numerical solution was found for the problem of the supersonic flow of an ideal gas past a plane triangular wing with a positive angle-of-attack. If the leading edge of the wing is supersonic, then a compression wave arises on the lower surface adjoining the leading edge, so that flow past the upper and lower surfaces of the wing proceeds independently. In the case considered, the stream region disturbed by the presence of the wing is a conical flow. The center of conicity coincides with the apex of the wing. The method of calculating the flow at the leading edge (an oblique Prandtl–Meyer flow occurs at the leading edge of the wing's upper surface) and in the central region is given. R.T.K.

N64-12492 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPROXIMATE MODELING OF WING FLUTTER IN HYDRO-PAN
D. A. Munshtukov *In its* News of Higher Educational Inst., Aviation Aviation Technol. 20 Sep. 1963 p 6–13 refs (See N64-12490 04-01)

A qualitative study of the type of flutter that is observed in the interaction of bending and the torsional oscillation of a wing was made. A cylindrical flutter model was studied in a hydropan. A series of differential equations describing the movement of the cylindrical body in the hydropan and dependent on the depth of the liquid in the pan are given. Within definite boundaries, it was possible to use the gas hydraulic analogy (for establishing conformity of parameters of a plain nonstationary gas flow and open flow of a liquid) to obtain qualitative results explaining the effect of various factors and parameters on bending-torsional wing flutter. R.T.K.

N64-12577 Air Force Systems Command, Wright-Patterson AFB, Ohio Research and Technology Div.
METHOD OF DETERMINING EFFECTS OF HEAT CONDUCTION IN LEADING EDGE OF WIND TUNNEL MODELS Technical Documentary Report [Aug. 1962–Apr. 1963]
Linn E. Miller and Wilbur L. Hankey, Jr. Oct. 1963 58 p refs
(RTD-TDR-63-4035; AD-425468)

A technique is developed for correcting heat transfer data for conduction effects in the vicinity of the leading edges of wind tunnel models. A solution is obtained by solving the general heat equation as applied to a cylindrical leading edge under a step heat impulse by means of Fourier and Laplace transforms. The local temperature is found to be a power series in time for thin skin models. By comparison of wind tunnel data with the theory developed herein it was ascertained that only three terms in the series (second degree curve in time) adequately represented the data. The coefficient of the linear time term is shown to be directly proportional to the applied heating rate. This theory is applied to several hypersonic wind tunnel tests and results in the elimination of large conduction errors in the heat transfer coefficient data. Author

N64-12623 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AEROELASTIC DISTRIBUTION OF AERODYNAMIC LOADS FOR LIFTING SURFACES OF CONSTANT CROSS SECTION, TAKING END RESTRAINTS INTO CONSIDERATION
Augustin Petre and Cristian Stanescu 1 Nov. 1963 13 p refs Transl into ENGLISH from Studii si Cercetari de Mecanica Aplicata (Bucharest), no. 6, 1961 p 1193–1203
(FTD-TT-63-751/1+2+3+4; AD-424446)

A solution is given for the problem of finding the distribution of aerodynamic loads on wings. The problem is that of determining the spanwise twist distribution of the wing corresponding to the condition of stable equilibrium, and the solution starts from the equations of the theory of restrained twisting of rods with walls and a closed profile. The treatment of the problem with consideration of restrained torsion implies that some additional boundary conditions are satisfied, and this recasts the phenomenon in a form closer to reality. C.L.W.

N64-12904 Royal Aircraft Establishment, Farnborough, (Gt. Brit.)
EXACT SOLUTIONS FOR WINGS HAVING ONE AND TWO PLANE SHOCK WAVES [TOCHNYE RESHENIYA DLYA NESUSHCHIKH SISTEM S ODNIM I DVUMYA PLOSKIMI SKACHKAMI UPLOTNENIYA]
V. V. Keldysh London, Min. of Aviation, Sep. 1963 25 p refs Transl. into ENGLISH from Inzh. Zh., v. 1, no. 3, 1961 p 22–39
(R.A.E.-Trans.-1044)

The paper examines exact solutions for wings at hypersonic speeds corresponding to flows having one and two attached shock waves. The geometrical and aerodynamic characteristics of bodies in designed conditions of operation are determined. Author

N64-13303 Hydronautics, Inc., Laurel, Md.
EXPERIMENTAL INVESTIGATION OF THE VISCOUS EFFECTS ON BALANCED JETS IN GROUND PROXIMITY [Final Report]

E. S. Curtis and V. R. Pfisterer Oct. 1963 32 p refs
(Contract DA-44-177-TC-845)
(TRECOM-TR-63-61; AD-426131; Tech. Rept. 41-3)

This report covers an experimental investigation of the flow field beneath a two-dimensional ground effect machine and in the vicinity of its peripheral jet for various nozzle heights. The purpose of this investigation was to provide experimental information for comparison with theoretical results. Specifically, the shape and location of impingement on the ground of the dividing streamline were determined; measurements of the approximate size and shape of the base vortex were made along with vorticity and velocity measurements; and measurements of pressures along the base of the machine were made. Author

N64-13358 Aeronautical Research Council (Gt. Brit.)
THE AIRFORCES ON THE LOW-ASPECT-RATIO RECTANGULAR WING OSCILLATING IN SONIC FLOW
D. E. Davies London, HMSO, 1963 46 p refs
(ARC-R&M-3339; supersedes RAE-TN-STRUCT-311, ARC-23950) Available from HMSO: 8s 6d

Approximate expressions for the generalized air forces acting on a rectangular wing of low aspect ratio oscillating harmonically in sonic flow at low frequencies are derived. The modes of oscillation considered are rigid modes with a small selection of flexible modes. Results are presented as the first few terms of infinite expansions. A brief description of the modes of oscillation and of the generalized air forces is given. Author

N64-13360 Aeronautical Research Council (Gt. Brit.)
ON THE NUMERICAL EVALUATION OF THE DRAG INTEGRAL
Evelyn Eminton London, HMSO, 1963 18 p refs
(ARC-R&M-3341; supersedes ARC-24063) Available from HMSO: 7s 6d

By means of a Fourier analysis a function is derived which gives the minimum of the integral

$$I = -\frac{1}{2\pi}\int_0^1\int_0^1 S''(x)S''(y)\log|x-y|\,dx\,dy$$

for any function $S(x)$ which has a continuous first derivative and given values at a number of discrete points. This minimal function suggests a method for the numerical evaluation of I from a graph or table of $S(x)$. An example is constructed to illustrate the method and to give some indication of its accuracy. Author

N64-13377 Aeronautical Research Council (Gt. Brit.)
MEASUREMENTS AT MACH NUMBERS UP TO 2.8 OF THE LONGITUDINAL CHARACTERISTICS OF ONE PLANE AND THREE CAMBERED SLENDER 'OGEE' WINGS
C. R. Taylor London, HMSO, 1963 44 p refs
(ARC-R&M-3328; supersedes RAE-AERO-2658; ARC-23776) Available from HMSO: 17s

Measurements have been made of the longitudinal characteristics of one plane and three cambered slender ogee wings ($\rho = 0.45$, $s_T/c_0 = 0.208$) at two subsonic and eight supersonic Mach numbers up to 2.8. The tests also included measurements of the zero-lift pressure drag and support interference of the plane wing. The results have been analyzed to give data for estimating the performance of supersonic transport aircraft. Author

N64-13383 Aeronautical Research Council (Gt. Brit.)
THE LOADING OF HELICOPTER ROTOR BLADES IN FORWARD FLIGHT
M. A. P. Willmer London, HMSO, 1963 45 p refs
(ARC-R&M-3318; supersedes RAE-NAVAL-2, ARC-21233) Available from HMSO: 18s

A method is described for calculating the spanwise loading of helicopter rotor blades in forward flight at various azimuth angles with considerably more accuracy than has been possible hitherto. The method is an extension of Glauert's lifting-line theory. The problem is reduced to solving a series of simultaneous linear equations, and the computations were performed by an electronic digital computer. Theoretical results obtained by this method for tip speed ratios of 0.08, 0.15, and 0.29 show considerably better agreement with experimental results than that obtained by previous methods. The report also shows how the theory may be used to calculate the vertical forces transmitted by the blades to the rotor hub by a more accurate method than has hitherto been employed. Author

N64-13385 Aeronautical Research Council (Gt. Brit.)
LOW-SPEED WIND-TUNNEL MEASUREMENTS ON A THIN SHARP-EDGED DELTA WING WITH 70° LEADING-EDGE SWEEP, WITH PARTICULAR REFERENCE TO THE POSITION OF LEADING-EDGE-VORTEX BREAKDOWN
J. A. Lawford and A. R. Beauchamp London, HMSO, 1963 13 p refs
(ARC-R&M-3338; supersedes RAE-TN-AERO-2797; ARC-23725) Available from HMSO: 6s

The position of the breakdown of the tightly rolled leading-edge vortex was observed, using a smoke technique. The breakdown point moved forward with increasing incidence and reached a point above the trailing edge at an incidence of 32°. It moved forward to transverse planes through 0·5 and 0·28 of the center-line chord at 34° and 37° incidence, respectively. The rms intensity and the low-frequency component of pressure fluctuations both began to rise rapidly at approximately the same incidence (31°) at four widely spaced points on the wing. This rise in pressure fluctuations was accompanied by a similar increase in the low-frequency component of normal-force fluctuations. The lift slope decreased at incidences above 21°, coinciding with a marked decrease in longitudinal stability. The drag coefficient varied linearly with C_L^2 up to an incidence of about 24°. Author

N64-13391 Aeronautical Research Council (Gt. Brit.)
PRELIMINARY MEASUREMENTS IN A SHOCK TUNNEL OF SHOCK ANGLE AND UNDERSURFACE PRESSURE RELATED TO A NONWEILER WING
L. Pennelegion and R. F. Cash London, HMSO, 1963 22 p refs
(ARC-CP-684; supersedes NPL-AERO-1037, ARC-23945) Available from HMSO: 4s 6d

Undersurface pressures and shock angles have been measured at one station on a Nonweiler wing at $M_\infty = 8.8$ and compared with the theory for two-dimensional flow about a wedge. The measurements have been made in a closed jet of a shock tunnel driven by nitrogen or helium, using nitrogen as the test gas. A miniature high pressure quartz transducer is buried into the wing, and used to measure pressures up to 1 psia. The pressure gage is calibrated statically by gaged gas pressure, and dynamically in a calibration shock tube. Shock angles and pressures have been measured in the incidence range of −5.5° to +20° for a Nonweiler wing of design incidence 10° and found to agree closely with the solution for the flow about a two-dimensional wedge. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-12680 Air Force Systems Command, Wright-Patterson AFB, Ohio

CATEGORY II LOW TEMPERATURE EVALUATION OF A YUH-1D HELICOPTER IN THE ARCTIC Technical Documentary Report [20 Dec. 1962-17 Jan. 1963]

Billy L. White Sep. 1963 160 p

(ASD-TDR-63-564; AD-422643)

The model YUH-1D helicopter was tested at temperatures down to −51° F in the Arctic. This report presents the data that was collected during the test and a discussion and analysis of the low-temperature deficiencies that were encountered. The most significant deficiencies that were encountered were excessive engine oil pressure during starts below −20° F, and erratic operation of the bleed-air driven fuel boost pump. Author

N64-12910* National Aeronautics and Space Administration, Washington, D.C.

X-15 NEARS 100TH RESEARCH MISSION WITH FASTER VERSION DUE IN 1964 News Release 64-3

7 Jan. 1964 5 p

Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

Attention was directed towards successful research studies associated with the X-15 research aircraft and proposed future missions of the program. In the research program engineers and technicians completed major phases of boundary-layer studies, optical degradation experiments, and investigations to determine the effects of air pressure, speed, and angle-of-attack on aerodynamic heating. Experimental work was accomplished on stability and control during reentry from high altitudes, advanced flight control systems, structural dynamics, and the measuring of physiological effects on pilots under extreme flight environments. Mentioned was the modified X-15 No. 2 which will have greater usefulness in conducting scientific investigations as it performs at speeds up to Mach 8.

C.L.W.

N64-12918 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)

MODELS FOR HELICOPTER DYNAMIC STABILITY INVESTIGATIONS

L. R. Lucassen and F. J. Sterk Jun. 1963 11 p

(MP-220)

A mathematical model is described, which has been devised for improving the physical understanding of helicopter dynamic instability in hovering (two degrees of freedom). A demonstration model has been built according to this principle. The influence of parameters, artificial stabilization, and sling load on the dynamic characteristics is shown. Author

N64-12919 California U., Berkeley Hydraulic Engineering Lab.

RESEARCH ON ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE OPERATING OVER WATER: WATER SURFACE CONFIGURATION

J. D. Cumming Sep. 1963 85 p refs

(Contract Nonr-222(71))

(*Its* IER Ser. 187, Issue 3; AD-423507)

A Ground Effect Machine operating over water is influenced by the manner in which the water surface is distorted under the GEM. A multiple wave gage was designed to record the time history of the water surface at various positions as the GEM passed overhead. Experiments were made using two different angles of jet inclination (−20 and −60 degrees), at various airflow rates, clearance heights and forward speeds. The shape of the cavity formed between the GEM and the water was found to be dependent on the forward velocity. The general shape was similar for the different jet inclination angles and the various flow rates and clearance heights used. The relative size of the cavity increased with increasing flow rate and decreasing height. Author

N64-12927 Textron Electronics, Inc. Sylmar, Calif. Heliotek Div.

HIGH EFFICIENCY SILICON SOLAR CELLS Fourth Quarterly Progress Report, 15 Mar.-15 Jun. 1963

Paul A. Berman 15 Jul. 1963 refs

(Contract DA-36-039-SC-90777)

(AD-422529)

Five hundred P^+/N and five hundred N^+/P cells were fabricated on a pilot line basis. There was a 70% yield of P^+/N cells having a 100 mw/cm^2 sunlight efficiency of 11.4% or greater. There was a 70% yield of N^+/P cells having a 100 mw/cm^2 sunlight efficiency of 10.1% or greater. Preliminary measurements indicate a substantial increase in efficiency for both cell types at solar intensities of approximately 300 mw/cm^2, due to the specific design of these cells for operation at these intensities, thus showing good performance for operation in systems utilizing solar concentrators. Comparisons are made between the pilot line N^+/P and P^+/N cells; and between these cells and commercially available production cells of both polarities. Cost estimates are given on the basis of the yields obtained. Author

N64-12932 California U., Berkeley Hydraulic Engineering Lab.

RESEARCH ON ANNULAR NOZZLE TYPE GROUND EFFECT MACHINE OPERATING OVER WATER: OPERATION OVER WAVES Technical Report

R. L. Wiegel, J. D. Cumming, Yuan Jen, J. A. Williams, and M. Sullivan et al Sep. 1963 86 p refs

(Contract Nonr-222(71))

(IER Ser. 187, Issue 7; AD-422977)

The effect of the periodic water waves on the base pressures and lift of the ground effect machine is examined. Tests were made with both 40- and 60-degree modified nozzles. The similarity of airflow characteristics and the relationships among wave and pressure characteristics are discussed, and conclusions are presented. J.E.T.

N64-12958* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

DESCRIPTION OF AN ANALOG COMPUTER APPROACH TO V/STOL SIMULATION EMPLOYING A VARIABLE-STABILITY HELICOPTER

John F. Garren, Jr., and James R. Kelly Washington, NASA, Jan. 1964 15 p refs
(NASA TN D-1970) OTS: $0.50

In order to provide means for accurate inflight simulation of V/STOL aircraft, a computer model technique has been adapted to a variable-stability helicopter. Unlike the stability-derivative simulation technique, which is usually employed in variable-stability aircraft, the model approach produces a response which is independent of the dynamics of the test vehicle. The aircraft response, therefore, is a function only of the evaluation pilot's control inputs and the dynamics which are programed into the analog computing equipment. Inflight time histories of the helicopter response and the corresponding commanded response are presented to illustrate the effectiveness of the technique. The results indicate that the model technique does, in fact, provide a feasible, accurate, and flexible approach to inflight simulation. Author

N64-12961* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
COMPARISON OF FLIGHT PRESSURE MEASUREMENTS WITH WIND-TUNNEL DATA AND THEORY FOR THE FORWARD FUSELAGE OF THE X-15 AIRPLANE AT MACH NUMBERS FROM 0.8 TO 6.0
Jon S. Pyle Washington, NASA, Jan. 1964 31 p refs
(NASA TN D-2241) OTS: $0.75

The results of flight pressure measurements on the forward fuselage of the X-15 airplane are presented for angles-of-attack from 0° to 15° and Mach numbers from 0.8 to 6.0. Comparisons of flight and wind-tunnel data showed good agreement, and theoretical calculations predicted flight pressure measurements reasonably well. Author

N64-13151 Advisory Group for Aeronautical Research and Development, Paris (France)
THE PROBLEMS OF DESIGNING FOR THE TAKE-OFF AND LANDING OF HIGH-SPEED AIRCRAFT
A. N. Clifton (Vickers-Armstrongs Aircraft, Ltd.) Jan. 1963 19 p Presented at the Aircraft Take-Off and Landing Specialists' Meeting sponsored by the AGARD Flight Mech. Panel, Paris, 15–18 Jan. 1963
(AGARD 413)

This report discusses, in a general way, a number of well-known problems connected with the takeoff and landing of high-speed aircraft, for example, wing loading, power loading, the use of high-lift devices, size and movement of the control surfaces, the pilot's view, the effect of slush, the use of arrester gear, protection against birds, and so on. The figure of 15 percent of the total design and development cost is stated to be attributable to the takeoff and landing processes. Data are given to show the effect of variable sweep and of various types of arresting systems on takeoff and landing characteristics. Author

N64-13355 Aeronautical Research Council (Gt. Brit.)
SIMPLIFIED LOADING FORMULAE FOR PULL-OUT MANOEUVRES OF TAILED AIROPLANES
S. Neumark London, HMSO, 1963 55 p refs
(ARC-R&M-3327; supersedes RAE-AERO-2608, ARC-20666) Available from HMSO: £11s

A method, alternative to that in common use at present, of calculating the response quantities in pullout maneuvers relevant to important cases of loads and stresses in airplane structures, is presented. The method, based on 'trapezoidal' elevator input, leads to final solutions in the form of closed formulas, which are not only convenient from the computational point of view but which also permit a comprehensive discussion. It may be used at every stage of design, including the earliest estimates. An important part in all this work is played by "overshoot factors," and complete charts of these are included. The method can be easily extended to cover asymmetrical maneuvers. Author

N64-13362 Aeronautical Research Council (Gt. Brit.)
8FT. X 6FT. TRANSONIC WIND TUNNEL TEST ON A 1/24 SCALE MODEL OF THE FAIREY DELTA 2 (ER.103)
D. J. Kettle London, HMSO, 1963 82 p refs
(ARC-CP-656; supersedes RAE-AERO-2662; ARC-24740) Available from HMSO: 14s

Measurements of longitudinal and lateral stability have been made on a 1/24 scale model of the Fairey Delta 2 (ER.103) in an 8 ft x 6 ft transonic tunnel, at Mach numbers from 0·85 to 1·25. The results also include some data on elevator, aileron, and rudder power. Some comparisons are made with the results of tests on the same model in a 3 ft x 3 ft supersonic tunnel. Author

N64-13384 Aeronautical Research Council (Gt. Brit.)
THE LATERAL MOTION OF AIRCRAFT, AND IN PARTICULAR OF INERTIALLY SLENDER CONFIGURATIONS
W. J. G. Pinsker London, HMSO, 1963 56 p refs
(ARC-R&M-3334; supersedes RAE-AERO-2656, ARC-23434) Available from HMSO: £1 5s

The kinematic and dynamic characteristics of the lateral motion of aircraft are described and reduced to simple models. After a review of the typical lateral modes of traditional aircraft configurations it is shown that with modern low-aspect-ratio designs at higher incidences the lateral oscillation tends to degenerate into a simple rolling oscillation about the principal inertia axis, whereas the roll subsidence is increasingly dominated by yawing moments. The consequences of these phenomena from the point of view of the stability and control of such aircraft, described as inertially slender, are discussed in detail, and approximate formulae are given which permit the early assessment of the general trends in the stability and response characteristics of this class of aircraft. Author

N64-13387 Aeronautical Research Council (Gt. Brit.)
ON THE EFFECT OF FAN AND THRUST ENGINE LOADING ON THE TRANSITION POWER REQUIREMENTS OF A FAN WING
N. Gregory London, HMSO, 1963 22 p refs
(ARC-CP-690; supersedes NPL-AERO-1011, ARC-23712) Available from HMSO: 4s 6d

The ideal power requirements of a fan wing in transition have been calculated, and the effects are shown of varying the fan and thrust engine areas relative to that of the wing, and of varying the wing aspect ratio. Comparison with wind-tunnel results confirms the presence of adverse jet–mainstream interaction effects neglected in the calculations. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics, and 29 Space Sciences.

N64-12425 Technische U., Berlin (W. Germany) Inst. für Flugfuhrung und Luftverkehr

FUNDAMENTALS OF CELESTIAL MECHANICS FOR SPACE FLIGHT GUIDANCE [HIMMELSMECHANISCHE GRUNDLAGEN DER RAUMFAHRZEUGFUHRUNG]

E. Rössger and H. Widlok Nov. 1963 139 p refs In GERMAN (Rept. 27)

The fundamentals of the celestial mechanics of spaceflight guidance are reviewed. The basic laws of the two-body problem are discussed, and an approximation-model of this problem is presented. This model is applied to the treatment of interplanetary flight as a two-body problem. The n-body problem presents more difficulties than the two-body problem, since a closed-form mathematical solution is not possible. The problem where n = 3 is discussed with emphasis on the Lagrange solution and the "limited" three-body problem. Also, lunar flight is considered as a "limited" three-body problem. In addition, the disturbance theory (the theory of the motion of a body in a noncentral field) is discussed. I.v.L.

N64-12949* California Inst. of Tech., Pasadena Div. of Geological Sciences

ORGANIC COMPOUNDS IN STONY METEORITES

I. R. Kaplan, E. T. Degens, and J. H. Reuter Repr. from Geochim. Cosmochim. Acta, v. 27, 1963 p 805–834 refs

(NASA Grant NsG-347)

Eight carbonaceous chondrites, five noncarbonaceous chondrites, and one achondrite were examined for organic constituents. Hydrocarbon-type organic matter was extracted from the samples with organic solvents (benzene–acetone and acetone–methanol) and studied by ultraviolet, visible and infrared absorption spectroscopy and by nuclear magnetic resonance spectroscopy. Both aliphatic and aromatic compounds were detected; in addition carbonyl groups appeared to be present as well as unsaturated groups of the vinyl or allylic type. Amino acids and sugars were encountered in all the meteorites studied. Acid hydrolyzates of carbonaceous chondrites contained 16 diazonium-sensitive compounds, 4 of which had the chromatographic properties (in terms of F_f value and color) of *m*-hydroxybenzoic, *p*-hydroxybenzoic, *p*-hydroxyphenylacetic, and vanillic acids. All extracts were tested for optical rotation on a polarimeter capable of measuring 0.0005°. No rotation could be detected. The absence of rotation, the type and distribution pattern of amino compounds in chondrules and matrix, lack of pigments, fatty acids, and presumably nucleic acids in addition to other biochemical criteria suggest that the organic material has been synthesized by chemical rather than known biochemical processes. Author

N64-13010 California U., La Jolla

ISOTOPIC COMPOSITION OF GERMANIUM IN METEORITES

Masako Shima Repr. from J. Geophys. Res., v. 68, no. 14 15 Jul. 1963 p 4289–4292 refs

(NASA Grant NsG-323; Contract AT(11-1)-34)

The isotopic composition of germanium in eight meteorites was measured by solid-source mass spectrometer and compared with a sample of terrestrial origin. No differences were found in the isotopic composition of germanium from meteorites, and the terrestrial sample was found outside of the error. Author

N64-13035 Lincoln Lab., Mass. Inst. of Tech., Lexington

RADAR ASTRONOMY MEASUREMENT TECHNIQUES

P. E. Green, Jr. 1 Oct. 1963 84 p refs

(Contract AF 19(628)-500)

(MIT-TR-282; AD-400563)

This report is a review of currently available techniques for studying the properties of objects of interest in radar astronomy, which are usually spread radar targets. Spread targets are defined to be those that produce an observable smearing of the echo in range, or an observable rate of echo fluctuation, or both. The approach taken in presenting the available material on spread target measurements is to follow what happens to the various attributes (amplitude, delay, phase, frequency shift, polarization) of an incident signal upon reflection from such a target. Then the question is turned around by detailing the ways in which the study of these signal attributes by appropriate receiver processing can be used to infer target properties. In the case of such radar astronomy targets as rotating planets, these target properties might include range, velocity, shape, size, rotation vector, and surface characteristics. Author

N64-13043 Office of Technical Services, Washington, D.C.

THE SYSTEM OF GLOBULAR CLUSTERS

P. P. Parenago, B. U. Kukarkin, and N. F. Floria [Aug. 1962] 24 p refs Transl. into ENGLISH of an article from Tr. Gos. Astron. Inst. im P. K. Shternbergn (Moscow), v. 16, 1949 p 47–70

(Rept. 63-14917) OTS: $2.60 ph, $0.89 mf

The goal was set of making a revision of the fundamental astrostatistical data on globular clusters in the Milky Way galaxy as the basis for determining the true distribution in space of the clusters. The data include: apparent integrated photographic magnitudes and apparent distance moduli of globular clusters; absolute photographic magnitudes of globular clusters; the determination of the true moduli; the diameters of globular clusters and light absorption; and the distribution of globular clusters in space. C.L.W.

N64-13157* National Aeronautics and Space Administration, Washington, D.C.

RADAR INVESTIGATION OF METEORS AT HIGH RATES OF DETECTION

C. Ellyett, C. S. L. Keay, and E. C. Mc Lauchlan (Canterbury U.) Jan. 1964 43 p refs

(NASA Grant NsG-219-62)

(NASA TN D-2244) OTS: $1.25

The construction and operation of an improved type of radar system for delineating meteor radiants is discussed. High rates of detection, quite often exceeding 1,000 meteors per hour, have been obtained. It is found that the very faint meteors which are detected in such large numbers completely obliterate many of the recognized showers. Author

N64-13258 Temple U., Philadelphia, Pa.

RESEARCH DIRECTED TOWARD THE DESIGN, CONSTRUCTION, AND ANALYSIS OF EXPERIMENTS FOR DETERMINING INFLUX RATE OF METEORITIC PARTICLES IN THE EARTH'S ATMOSPHERE Final Report, 1 Oct. 1959–31 Dec. 1962

J. Lloyd Bohn 15 Jun. 1963 43 p refs

(Contract AF 19(604)-5870)

(AFCRL-63-663; AD-425653)

A review of accomplishments is presented. Two micrometeorite-detection experiments were flown in Nike-Cajun rockets I and II. The instrumentation for Nike-Cajun II represented significant refinement over that used in Nike-Cajun I. Improvement and construction of amplifiers and transducers were undertaken. Also, methods for more efficient field calibration of instruments were devised. During the course of seeking to improve micrometeorite detection instruments, apparatus

in the form of micromomentum pulsers and impact-time measuring equipment were developed. Some work was done on the design of an accelerator for small particles, which, when completed, should permit the simulation of micrometeorite phenomena in the laboratory. In addition, some theoretical consideration was given to the mass and velocity distribution, impact phenomena, and penetration times of micrometeorite materials. I.v.L.

N64-13322 Aberdeen Proving Ground, Md. Ballistic Research Labs.

AN ORDVAC PROGRAM FOR THE COMPUTATION OF STANDARD COORDINATES OF THE SUN

A. Roberta Wooten Sep. 1963 16 p refs

(BRL-MEMO-1517; Suppl. to BRL-MEMO-1451)

The formulas for the computation of standard coordinates (ξ and η) of the stars and sun are identical with one exception. The star computation updates the star positions (α and δ) for the date of observation, whereas the sun computation corrects the sun position ($\alpha_\odot$ and $\delta_\odot$) for geocentric parallax. This paper details the change in the star reduction to compute standard coordinates of the sun. The computation of standard coordinates of the sun has been programed for the ORDVAC. Author

N64-13328 California U., La Jolla Scripps Inst. of Oceanography

CHONDRULES AND THE METEORITE PARENT BODIES

Kurt Fredriksson Repr. from Trans. N.Y. Acad. Sci., Ser. II, v. 25, no. 7, May 1963 p 756–769

A discussion is presented of new data obtained in regard to the origin of chondrules and various types of chondrites. Three possibilities of chondrule origin are discussed in particular: (1) volcanism on one or several parent bodies; (2) splash drops in collisions; and (3) condensation from a gas cloud. Basic problems that must be considered in setting up a model of a parent body, or bodies, for chondrites are elucidated. The relation between chondrites, iron meteorites, and achondrites is also discussed. P.V.E.

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-12456 Joint Publications Research Service, Washington, D.C.

AUTOMATION OF THE CONTROL PROCESSES FOR DEVELOPMENT OF LARGE SYSTEMS OR COMPLICATED COMPLEXES

G. S. Pospelov and A. I. Teyman *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 86–114 refs (See N64-12451 04-01) OTS: $5.00

Several mathematical methods of planning the development of large systems known in the United States of America primarily as PERT Methods are discussed. Author

N64-12463 Joint Publications Research Service, Washington, D.C.

APPROXIMATE DESIGN OF RAPID ACTION SYSTEMS WITH AUTOMATIC OPTIMIZATION WHEN ALMOST PERIODIC TENTATIVE AND SEARCH SIGNALS ARE USED

Yu. I. Alimov and V. K. Obabkov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 179–195 refs (See N64-12451 04-01) OTS: $5.00

The low parameter method in connection with frequency representations is applied to theoretical analysis of the dynamics of continuous automatic control systems with extremal self-tuning of the correcting circuits when almost periodic tentative signals and search signals are present. Author

N64-12468 Joint Publications Research Service, Washington, D.C.

AN AMPLITUDE-FREQUENCY TRANSFER FUNCTION OF A RELAY CONTROL MECHANISM WITH AN INDEPENDENTLY DRIVEN MOTOR

V. I. Tsvetkov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 233–242 refs (See N64-12451 04-01) OTS: $5.00

The universal amplitude-frequency transfer function of a relay control mechanism with an independently driven motor is obtained taking into consideration the load time. It is obtained on the basis of the solution of the nonlinear problem by the fitting method with the utilization of harmonic linearization. In doing this the jump-type changes in the differential equation of motion of the motor are taken into account for operation and release of the relay and for changes in the sign of time from the force of drive friction connected with changes in the sign of the velocity. The universal normalized amplitude-phase-frequency characteristics for various values of the load time are constructed. Author

N64-12471 Joint Publications Research Service, Washington, D.C.

ON THE DETERMINATION OF OPTIMUM PARAMETERS FOR RADIAL-SLOT SHUTTERS OF DISPLAY SYSTEMS FOR LUMINOUS OBJECTS

V. D. Andreyev *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 262–277 refs (See N64-12451 04-01) OTS: $5.00

The modulation by radial-slot shutters of luminous fluxes from a display object and a background is investigated. Formulas, determining frequencies, and amplitudes of the signals passing through the shutter to a photosensitive element are derived and analyzed. The dependency of the frequencies and amplitudes of the signals on the parameters of the radial-slot shutters and the magnitude of the display system with an arbitrary direction of viewing the object is investigated. Author

N64-12622 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AUTOMATION; SELECTED ARTICLES

Josef Chaloupka et al 21 Oct. 1963 30 p refs Transl. into ENGLISH from Automatizace (Czech.), v. 12, no. 12, p 332–338 and 343

(FTD-TT-63-763/1+2; AD-424449)

The types and functions of central measuring stations and their equipment are reviewed. The operational part of the central system is controlled by an automatic computer which regulates components or economical optimalization or both. Characteristic values of a computer are discussed in a separate article. J.E.T.

N64-12633 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RECTIFIERS AND STABILIZERS
P. G. Fedoseyev 4 Oct. 1963 650 p refs Transl. into ENGLISH of the book "Vypryamiteli i Stabilizatory", Moscow, Gos. Izd. Iskusstvo, 1960 p 1–518
(FTD-TT-63-245/1+2+4; AD-423401)

Three parts of this book are: (1) information on electric rectifiers and the principles of the general theory of rectifiers and smoothing filters; (2) an exposition of problems of regulation and stability of voltage and current, including material which has never been published before concerning the design of certain voltage-stabilizer circuits; and (3) typical electric power supply circuits used in motion picture engineering, and specific features of the supplied objects. J.E.T.

N64-12649 Army Missile Command, Huntsville, Ala.
ADCAT INNER-LOOP CONTROL SYSTEM ANALYSIS
Buster E. Kelley, William W. Malcolm, and Gordon D. Welford 11 Nov. 1963 53 p refs
(RD-TR-63-30; AD-423154)

The ADCAT inner-loop control system is analyzed to determine the performance and stability of the "bang-bang" control scheme. The data obtained from the computer simulation are compared to the measured data obtained from a breadboard setup. Compensation is determined which will allow the optimum performance of the inner-loop control system. Author

N64-12654 Thermo Electron Engineering Corp., Waltham, Mass.
EFFECT OF ELECTRODE CONFIGURATION ON THERMIONIC CONVERTER OUTPUT CHARACTERISTICS Annual Technical Summary Report, Mar. 1962–Mar. 1963
N. S. Rasor and S. S. Kitrilakis [1963] 72 p refs
(Contract AF 19(604)-8453)
(TE-5-64; AFCRL-63-712; AD-425656)

No significant difference was observed in the optimized power output of a converter with coaxial cylindrical electrodes from that obtained from one with plane-parallel electrodes. The current–voltage characteristics of the test vehicle studied could not be altered by creating a discharge at the edge of the interelectrode gap other than shifting the ignition voltage. The split collector configuration, however, proved a very useful tool in exploring both gaseous and surface phenomena occurring in the thermionic converter. Author

N64-12668 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DISCUSSION OF THE ARTICLE "CAPACITANCE D-C GENERATOR OPERATING ON A NEW PRINCIPLE"
A. F. Kalganov and L. S. Polotovskiy 27 Mar. 1963 14 p refs Transl. into ENGLISH of an article from Izv. Vysshikh Uchebn. Zavedenii, Elektromekhan. (Novocherkassk), no. 4, 1960 p 129–133
(FTD-FF-61-540/1; AD-401586)

A. F. Kalganov and L. S. Polotovskiy point out the following fallacies in the article "Capacitance D-C Generator Operating on a New Principle": (1) It is not clear what the author means by a new approach to the solution of the problem of a capacitance machine. (2) The magnitude of the charge q and the quantities γ and E_1 are irrelevant and unrelated to anything. (3) Inaccuracies exist in calculating the excitation voltage and the power of the generator. I.v.L.

N64-12669 Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
DEVELOPMENT OF AN EXPLODING BRIDGEWIRE FIRING UNIT
G. T. Hummert Aug. 1963 35 p refs
(ABL/X-103; AD-424556)

A general description of an exploding bridgewire system and a detailed study of a solid-state firing unit is presented. This firing unit approaches an optimum between reliability and safety as it contains few components, yet responds only to a coded electrical signal. Illustrations of the decoding circuit, construction details, recommended circuit modifications, and data obtained from a pre-prototype unit are also given. Author

N64-12674 Lockheed Missiles and Space Co., Sunnyvale, Calif.
AUXILIARY POWER SYSTEMS FOR SPACECRAFT: AN ANNOTATED BIBLIOGRAPHY
Peter R. Stromer, comp. May 1963 60 p 126 refs
(Contract AF 04(695)-136)
(LMSC-SB-63-46; AD-423714)

One hundred and thirty-five references have been selected from the 1962–1963 literature reporting research and development in auxiliary power systems for spacecraft. Emphasis has been placed on solar and nuclear auxiliary power sources with only a representative sampling of other concepts such as magnetohydrodynamics, biochemical and hydrox fuel cells, batteries, etc. Author

N64-12692* National Aeronautics and Space Administration, Washington, D.C.
THE PROBLEM OF THE DIRECT CONVERSION OF CHEMICAL ENERGY INTO ELECTRICAL ENERGY [PROBLEMA NEPOSREDSTVENNOGO PREVRASHCHENIYA KHIMICHESKOY ENERGII V ELEKTRICHESKUYU]
V. S. Bagotskiy and A. N. Frumkin Jan. 1964 22 p refs Transl. into ENGLISH from Vestnik Akad. Nauk SSSR (Moscow), no. 7, 1962 p 19–32
(NASA TT F-136) OTS: $0.75

Recent developments in the problem of converting chemical energy into electrical energy are reviewed. The mechanisms for such conversions are described and the prospects of utilizing electrochemical generators in modern technology are explored. Author

N64-12825 Naval Research Lab., Washington, D.C.
EXPERIMENTS WITH A MAGNESIUM SEAWATER CELL INCORPORATING A BACTERIAL COLONIZED CATHODE
B. J. Wilson 4 Oct. 1963 25 p refs
(NRL-5998; AD-423615)

A magnesium seawater cell with its cathode covered by a colony of special bacteria yields a higher voltage at a given current density than when bacteria are not present. This has been observed for current densities below one ampere per square foot. Volt–ampere characteristics were measured to determine how much the voltage performance improved, and if possible, why. On the basis of these tests, it is possible to conclude that the bacteria act to lessen cathodic polarization, and therefore the equivalent internal resistance of the cell, to an extent dependent on the hydrogen uptake coincident to their normal metabolism. A 5-month life test in a clean, shallow oceanic environment revealed that the cell shut down to zero output, due apparently to calcareous deposits formed from two distinct actions—the cell's normal electrochemical process and superposed action by film-forming organisms. Author

N64-12829 Union Carbide Consumer Products Co., Cleveland, Ohio

ALKALINE-MnO_2 BATTERY 5th Quarterly Report, 1 May-31 Jul. 1963

J. Winger 25 Sep. 1961 16 p refs
(Contract DA-36-039-SC-89098-02)
(AD-423090)

Six months' delayed testing of some earlier factory-made lots still shows better low-temperature service for experimental cells vs control. Intermediate temperature (0° F) testing in addition to previous −40° F testing also shows advantages with experimental cells over factory product. Seal work continues to demonstrate continuing improvements. Minimum military requirements of 30 days at 160° F and 90 days at 113° F have been surpassed. Author

N64-12871 Eagle-Picher Co., Joplin, Mo.

RESEARCH INVESTIGATIONS LEADING TO THE DEVELOPMENT AND EVALUATION OF A CADMIUM-SILVER OXIDE BATTERY HAVING A HERMETICALLY SEALED CONSTRUCTION Report No. 12 (Final), 1 Jul. 1962-30 Jun. 1963

J. K. Wilson 30 Jul. 1963 83 p
(Contract DA-36-039-SC-89065)
(AD-425938)

Among the areas investigated and discussed are improvement in separation, capacity efficiency, overcharge characteristics, retention-of-capacity at temperatures from −65° F to +165° F, and hermetic seals. In addition, the voltage, capacity, self-discharge, charge efficiency, and life characteristics of cells utilizing the positive plate at both the divalent and monovalent capacity levels are discussed. Sufficient data have been accumulated to allow the construction of sealed cells with acceptable performance characteristics. Author

N64-12873* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ENERGY ABSORBER FOR THE ARIEL I INSTRUMENT BOOMS

T. L. Eng Washington, NASA, Jan. 1964 15 p refs
(NASA TM X-936) OTS: $0.50

The instrument boom energy absorber aboard the Ariel I was designed on the principle of runaway escapement. Its function was to reduce the erection rate of the instrument booms, thereby minimizing the kinetic energy transferred to these booms during their deployment and thus further safeguarding the experiments carried by the booms from shock damages. This device consisted of a pulley coupled to a gear train, which in turn was regulated by a pallet on a scape wheel. Since the frequency of the pallet is a function of the actuating torque, its amplitude, and moment of inertia, the rate of movement of the escapement mechanism can be adjusted by making the pallet moment of inertia variable (the others constant). Ariel I was successfully launched on April 26, 1962. Telemetry data from the satellite indicated that all experiments carried by the booms had functioned normally. Author

N64-12875* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A LIGHTWEIGHT FOLDING BOOM FOR ACCURATELY PLACING SCIENTIFIC EXPERIMENTS UP TO 25 FEET FROM LARGE SPACECRAFT

John P. Bauernschub, Jr. Washington, NASA, Jan. 1964 11 p refs
(NASA TM X-941) OTS: $0.50

A feasibility study was conducted on large folding booms for spacecraft applications. The resulting design featured precise repeatability, permitted the passing of a large electrical cable directly through each knuckle, and used a constant-speed spring-driven motor to operate the knuckles by means of a cable. The entire assembly, including the spring motor, is completely nonmagnetic and is ideally suited for placing a magnetometer experiment a considerable distance from the spacecraft structure. It can also place many other instruments, such as antennas and solar-celled paddle systems, away from the structure. Author

N64-13001* Garrett Corp., Los Angeles, Calif. AiResearch Mfg. Div.

SATURN INSTRUMENT COMPARTMENT GROUND COOLING AIR CONDITIONER 682830-1 Final Summary Report

D. P. Strassel 10 Jul. 1962 64 p
(NASA Contract NAS8-1578)
(NASA CR-55218; AAC-4209-R) OTS: $6.60 ph, $2.12 mf

A summary is presented of the design approach, fabrication, functional and calibration tests of one service test unit air conditioner 682830-1, Serial 71-D1. The air conditioner was designed for use as a cooling source for the booster and top instrument compartments. The unit is intended for installation at the base of the umbilical tower with insulated flexible ducting between the air conditioner and missile compartment connections. The unit is a self-contained package requiring only external electrical power supply. R.T.K.

N64-13002* Mallory (P. R.) and Co., Inc., Burlington, Mass.

RESEARCH AND DEVELOPMENT OF A HIGH CAPACITY NONAQUEOUS SECONDARY BATTERY Quarterly Report No. 1

[1963] 42 p
(NASA Contract NAS3-2780)
(NASA CR-55015) OTS: $4.60 ph, $1.46 mf

A discussion is presented of the basic electrochemical principles, involved in the operation of a secondary battery, which have determined the analysis of the problems to be expected in the development of such a battery and of the program of research most likely to be productive of useful results. A description of the experimental work accomplished in the following areas is also presented: (1) anodizations in aqueous electrolytes, (2) anodization in nonaqueous electrolytes, and (3) preparation of beryllium dialkyl salts. R.T.K.

N64-13049 Atomics International, Canoga Park, Calif.

DESIGN AND DEVELOPMENT OF THE SAFETY-ROD DROP-TIME TEST SYSTEM

J. G. Radcliff 31 Oct. 1963 19 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-7880) OTS: $0.50

The SRE safety-rod drop-time system consists of electronic time-interval meters and magnetic pickups to measure free-fall drop time and snubbing time of the safety-rod poison elements prior to all normal reactor startups. The electronic timing system is panel mounted in the reactor control room. The snubber time and free-fall time are displayed on four-decade lighted dials on the two timers and are read directly in units of time. The complete drop-time measurements can be made at the test panel by one individual in less than 10 minutes. The timing system was developed to provide a rapid time-measurement technique to check for obstructions to free-fall and to measure snubber wear. Author

N64-13063* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPACT LUNAR POWER STATION
Edward E. Dungan 23 Aug. 1963 20 p refs
(NASA TM X-51372; MTP-ASTR-A-63-8) OTS: $1.60 ph, $0.80 mf

One of the initial requirements for a manned lunar scientific base will be an adequate, dependable supply of electric power. Minimum weight and long operating capabilities necessitate the use of nuclear energy. The power requirements for such a station should be in the megawatt (electrical) range. A conceptual design of a compact lunar power station includes a partially-shielded, liquid-metal cooled, fast reactor heat source; a primary heat exchanger; a redundant potassium Rankine cycle turboelectric generation system; and either a radiator or a lunar heat sink. A modular-designed compact lunar power station becomes an immediate candidate for logistic missions utilizing the Saturn V Lunar Logistic vehicle. The technology exists for designing and developing a power station of this type. Author

N64-13064* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A DESIGN OF ELECTRIC MACHINERY FOR LONG TIME ATTITUDE CONTROL OF SPACE VEHICLES
D. L. Teuber 25 Feb. 1963 21 p refs
(NASA TM X-51373; MTP-ASTR-R-63-3) OTS: $2.60 ph, $0.80 mf

An actuator is described that is to work in a control system in which an angular impulse acting on a vehicle is counteracted by the acceleration of a flywheel in each of three mutually perpendicular axes. The system will work in a vacuum and provide a torque proportional to the sum of error and rate of error signal. The concept of the electronic commutator eliminates brushes; the position of the rotor with respect to the stator windings is sensed and energized through an amplifier system that switches the corresponding stator winding. A high efficiency is obtained by matching back electromotive force (EMF) and applied voltage in four concentrated windings in addition to the use of a permanent magnet and a relatively wide airgap. The desired control characteristic of a torque independent of motor speed but proportional to a signal is achieved by feedback loops and a constant current output of a dc/dc inverter. Author

N64-13072 RAND Corp., Santa Monica, Calif.
THE FISSION-ELECTRIC CELL PROJECT
George Safonov Oct. 1963 178 p
(Contract AF 49(638)-700)
(RM-3908-PR; AD-421995)

Results of the Fission-Electric Cell Project, a research and development effort aimed at converting atomic energy directly into electrical energy are presented. The memorandum is divided into the following sections: (1) converters of fission to electric energy—a background discussion; (2) concept history prior to 1962; (3) project facilities; (4) cell technology from irradiations during 1962; (5) cell surface technology from 1962 operations; (6) facility improvements during 1962; (7) the overall status of fragment-electricity research; and (8) appendix—the fission-electric reactor, patents filed and granted, the magnetron field unit, and the beam and shielding. P.V.E.

N64-13091 General Electric Co., Washington, D.C.
A STUDY OF SYSTEM MODELING TECHNIQUES Final Report
Stanley B. Rosen, Essie S. Nevans, Richard M. Walden, Walter Asmuth, Jr., and Louis C. Marshall Bedford, Mass., Directorate of Computers, Oct. 1963 205 p refs
(Contract AF 19(628)-2973)
(ESD-TDR-63-612; AD-424561)

This study was undertaken to ascertain the suitability of the modeling technique to describe complex Air Force Command and Control Systems. The 473L, BMEWS, and 412L Systems were modeled with emphasis on timing and accuracy applications. Some simulation has been performed. From results obtained it was concluded that the modeling technique is suitable. Several recommendations for additions to the technique were given. Author

N64-13104 Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
DESIGN OF HYDROGEN-OXYGEN CAPILLARY TYPE FUEL CELL 6th Quarterly Technical Progress Report, 1 Aug.–31 Oct. 1963
N. P. Bannerton and J. C. Prestridge 15 Nov. 1963 52 p
(Contract AF 33(657)-8970)
(AD-423722)

During this reporting period, operational and environmental testing of the orbital package and components continued. The work performed involved the following: operational and vibration testing of transducers and regulators and their mountings; operational, cyclic, and surge testing of pressure regulators and rework of package components for weight reduction. Author

N64-13122 General Dynamics/Convair, San Diego, Calif.
FULL-SCALE DEMONSTRATION OF VERTICAL FLOAT SEA-STABILIZATION CONCEPT. PHASE 1 REPORT
D. B. Dewey Oct. 1963 30 p refs
(Contract NOw 63-0793-f)
(GD/C-63-200; AD-424034)

This report presents the results of open ocean testing of two PBM-5 seaplanes—one equipped with the vertical float installation and the other with a standard hullborne configuration. Both seaplanes were towed to open sea locations for comparison of pitch, roll, and heave in Sea States I and II. Both seaplanes were instrumented and manned by volunteer Navy crews to record crew reactions to extended exposure to wave induced motions. The report includes comparative plots of pitch, roll, and heave for the two configurations. Author

N64-13170* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROTECTING EXPLORER XVI SOLAR CELLS
John L. Patterson and William E. Miller Repr. from Astronautics and Aerospace Eng., Oct. 1963 p 48–51 refs
(NASA RP-115)

Research was conducted to develop improved means of radiation protection of solar cells. An experimental program helped to establish the additional window thickness required and to qualify types of fused quartz that could be procured rapidly. Relatively economical quartz windows were made by a vapor deposition method, and promise solar-cell service lifetimes of greater than a year in man-made radiation belts. C.L.W.

N64-13179* Aeronutronic, Newport Beach, Calif.
INITIAL RELIABILITY GOALS AND APPORTIONMENT–LUNAR FACSIMILE CAPSULE
L. R. Lerum 7 Jan. 1963 8 p
(Contract JPL 950462)
(NASA CR-55216; U-1969)

A landing-gear assembly reliability goal has been established and has been apportioned to appropriate subassembly levels. This was done in order to provide each equipment designer with a design parameter, compatible with the overall assembly reliability goals, with which his design is expected to comply. Establishment of these goals also provides for greater program visibility in that it facilitates evaluations, comparisons, and tradeoffs; directs proper engineering emphasis to potential problem areas; and provides a measure to which the design can be compared as the design progresses. The landing-sphere assembly reliability goal and the goals for the major subassemblies are listed in a table. The apportionment of the facsimile system is given in a separate table. Finally, the method of arriving at the apportionment is given. C.L.W.

N64-13187* Atomics International, Canoga Park, Calif.
RADIATION EFFECTS ON ELECTRODE BEHAVIOR Midpoint Report, 1 Jun.-31 Aug. 1963
G. R. Argue, H. L. Recht, and W. A. Mc Collum Pasadena, Calif., Jet Propulsion Lab., 14 Oct. 1963 25 p
(NASA Contract NAS7-100; JPL Contract 950514)
(NASA CR-55217; AI-8971) OTS: $2.60 ph, $0.95 mf

Laboratory experiments were carried out to determine the capacity, elevated temperature characteristics, and the general electrochemical behavior of 2-electrode cells under various current cycling regimes. These cells used electrodes taken from Gulton VO series Ni-Cd cells. Gamma irradiation runs have been carried out at the NAA Science Center Co^{60} source (dose rate = 1.9×16^6 rads/hr) and at the AI Co^{60} source (dr = 8×10^4 rads/hr). A small deterioration in output voltage with time (of the order of tens of millivolts) was observed at dosages of 10^8 rads, but the results were clouded by having to correct for the effects of a simultaneous high temperature produced in the source to obtain this figure. Sloughing off of electrode material, almost entirely from the cadmium (negative) electrode became apparent at about 6×10^6 rads. At 1.3×10^7 rads, or some lesser figure, the capacity of the cadmium electrode is drastically reduced. Author

N64-13197* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
METALLURGICAL EXAMINATION OF DEVELOPMENT-TYPE THERMIONIC POWER CONVERTERS
E. C. Bernett 15 Dec. 1963 23 p
(NASA Contract NAS7-100)
(NASA CR-55211; JPL-TR-32-548) OTS: $2.60 ph, $1.89 mf

Examinations were carried out on a number of thermionic power converters (diodes) after they had been tested to failure. The purpose was to check for failure causes and substandard material or workmanship. Some components of the early-model diodes showed very poor machine finishes; however, there was a noticeable improvement in the later models. The braze joints (particularly the metal–ceramic seal) continue to show a marked variation in structure from model to model, indicating a lack of process control in this area. Heavy foreign deposits were observed on the collectors of two diodes, and there was an intergranular cesium attack on two emitter sleeves. Author

N64-13237 Atomics International, Canoga Park, Calif.
CLAD CARBIDE NUCLEAR FUEL THERMIONIC POWER MODULES Second Quarterly Report [15 Jun.-15 Sep. 1963]
C. K. Smith Wright-Patterson AFB, Ohio, Research and Technology Div., Sep. 1963 37 p
(Contract AF 33(657)-10876)
(AI-9050; AD-420390)

The general objective is to evaluate a clad carbide emitter, thermionic power module which simulates nuclear reactor installation, design, and performance. The module is an assembly of two series-connected converters with a single common cesium reservoir. The program goal is 500 hr cumulative operation at a power density of 7 w/cm^2 and an efficiency of 12%. This report describes progress made including: (1) minor design refinement of several components, (2) completion of fabrication of all module components with the single exception of insulated collector structure, which is almost complete, (3) thermal stability tests of critical brazes and welds, (4) completion of the module performance evaluation test setup, (5) development and evaluation of fueled emitter fabrication techniques, (6) postoperation metallurgical examination of fueled planar emitter from fueled converter test. Author

N64-13285* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
DISCHARGE BEHAVIOR OF THE AgO-Ag ELECTRODE
E. A. Butler 22 Dec. 1963 13 p refs
(NASA Contract NAS7-100)
(NASA CR-53002; JPL-TR-32-535) OTS: $1.60 ph, $0.80 mf

The production of gas by AgO electrodes and by AgO powder and pellets in 40% KOH at 25° C was investigated. Little gas was evolved by any form of AgO during chemical reaction or electrochemical reaction, provided that the temperature of the material remained in the vicinity of 25° C. Gas was released by electrodes which had been treated at 100° C and was probably occluded oxygen produced by chemical decomposition of AgO. There was no evidence that gassing was affected by the electrode potential. Examination of partially discharged plates indicated that the electrochemical reaction occurred preferentially at physical discontinuities. Author

N64-13314 Harry Diamond Labs., Washington, D.C.
THE USE OF ELECTROCHEMICAL SYSTEMS FOR TIMING
Judith B. Lipnick 30 Oct. 1963 30 p refs
(HDL-TR-1156; AD-422899)

An investigation was conducted toward determining the feasibility of a military timer using a constant-current power supply, an electrochemical delay cell, and a suitable detector. Only the feasibility of developing an electrochemical delay cell is considered here. A review of electrochemical delay systems is presented. Limited preliminary tests of two commercial cells and of several experimental systems are described. Several systems were found to work accurately at room temperature and above. However, at low temperatures, the systems operate unreliably, exhibit high impedance, and have insufficiently sharp end-point indications. It may be possible to improve the performance of the cells in these respects through proper choice of electrolyte making an inexpensive cell practicable, with accuracies better than 1 percent for delay times of 100 sec to 1 year. Author

N64-13332* National Aeronautics and Space Administration, Washington, D.C.
FUEL CELLS – 1963
Ernst M. Cohn N.Y., Soc. of Automotive Engr., 1964 5 p refs Presented at the Automotive Eng. Congr., Detroit, 13–17 Jan. 1964
(SAE Paper 783A)

United States Government efforts directed at systems other than hydrogen-oxygen, primarily through the Dept. of Defense, are approaching the hardware stage via (1) reforming of hydrocarbons and their derivatives, and ammonia, (2) direct use

of alcohol in low-temperature fuel cells, (3) direct use of hydrocarbons in intermediate-temperature fuel cells, (4) gasification of coal and use in high-temperature fuel cells. Commercial applications of fuel cells appear to be many years in the future, and areas of potential usefulness of fuel cells in the civilian economy are not clearly defined at present.

Author

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-12474 European Atomic Energy Community, Brussels (Belgium)

CATIONIC RADIONUCLIDES AND THEIR DECORPORABILITY [KATIONISCHE RADIONUKLIDE UND IHRE DEKORPORIERBARKEIT]

W. H. Muller Ghent, Directorate-Gen. for Res. and Training, Biol. Serv., Oct. 1963 18 p refs Presented at the Pharm. Inst., Ghent U., 19 Apr. 1963 In GERMAN; ENGLISH Summary

(EUR 368.d) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 40 Belg. Fr.

The manner in which radionuclides enter an animal organism, the degree to which they are resorbed, and the organs they prefer are discussed. The toxicity depends on the radiation. Sr-90, for example, is about 10,000 times more toxic than its inactive isotopes. Among the decontaminants, the chelating agents are the most important. The efficiency of the chelating agent is a function of the stability of the nuclide-chelate and also of the ratio of this stability to that of the corresponding Ca-chelate. Physical and chemical properties of the chelating agent and the cationic radionuclide, which have an influence on the stability, are mentioned. At present, the most effective chelating agents are the polyamineacetic acids. Examples are given for the removal capacity of EDTA and DTPA. An apparently irreversible rule explains why an impressive removal of the radioactive isotopes of the alkaline earths Sr, Ba, and Ra has not been possible with chelating agents until now.

Author

N64-12486 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RESEARCH IN THE FIELD OF ORGANOSILICON COMPOUNDS; SYNTHESIS AND PHYSICO-CHEMICAL PROPERTIES (SELECTED ARTICLES)

19 Sep. 1963 82 p refs Transl. into ENGLISH from the book "Issledovaniya v Oblasti Kremniyorganicheskikh Soyedineniy; Sintez i Fiziko-khimicheskiye Svoystva", Moscow, Izd. AN SSSR, 1962 p 105–129, 130–145, and 166–167

(FTD-TT-63-451/1+2+4; AD-420764) OTS: $8.10

CONTENTS:

1. SYNTHESIS OF ORGANOSILICON COMPOUNDS WITH SILOXANE CARBON UNITS N. S. Nametkin, A. V. Topchiyev, and L. S. Povarov p 1–37 refs (See N64-12487 04-07)

2. SYNTHESIS OF ORGANOSILICON COMPOUNDS WITH SILAZANE-CARBON AND SILTHIANE-CARBON UNITS A. V. Topchiyev, N. S. Nametkin, and L. S. Povarov p 38–61 refs (See N64-12488 04-07)

3. CHLOROMETHYLATION OF ORGANOSILICON COMPOUNDS AND SYNTHESIS OF ORGANOSILICON COMPOUNDS FROM CHLOROMETHYLATED ALKYLBENZENES N. S. Nametkin, A. V. Topchiyev, and N. A. Pritula p 62–79 refs (See N64-12489 04-07)

N64-12487 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SYNTHESIS OF ORGANOSILICON COMPOUNDS WITH SILOXANE CARBON UNITS

N. S. Nametkin, A. V. Topchiyev, and L. S. Povarov *In its* Res. in the Field of Organosilicon Compounds; Synthesis and Physico-Chem. Properties 19 Sep. 1963 p 1–37 refs (See N64-12486 04-07) OTS: $8.10

A method is proposed for obtaining silicon-organic compounds, the basic chain of which is constructed of alternating silicon-methylene and siloxane links. Pentaalkylhydroxy- and tetraalkyldihydroxy derivatives of disilylmethane and linear as well as cyclic products of their condensation (containing siloxane-carbon links) were obtained. The physicochemical properties of the compounds obtained were characterized, and their viscosity-temperature relationship was studied.

R.T.K.

N64-12488 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SYNTHESIS OF ORGANOSILICON COMPOUNDS WITH SILAZANE-CARBON AND SILTHIANE-CARBON LINKS

A. V. Topchiyev, N. S. Nametkin, and L. S. Povarov *In its* Res. in the Field of Organosilicon Compounds; Synthesis and Physico-Chem. Properties 19 Sep. 1963 p 38–61 refs (See N64-12486 04-07) OTS: $8.10

Compounds with silazane-carbon and silthiane-carbon units were produced as reaction products of methylene chloride with silicon. The physicochemical properties of the compounds were found, and their viscosity-temperature characteristics were studied.

R.T.K.

N64-12489 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CHLOROMETHYLATION OF ORGANOSILICON COMPOUNDS AND SYNTHESIS OF ORGANOSILICON COMPOUNDS FROM CHLOROMETHYLATED ALKYLBENZENES

N. S. Nametkin, A. V. Topchiyev, and N. A. Pritula *In its* Res. in the Field of Organosilicon Compounds; Synthesis and Physico-Chem. Properties 19 Sep. 1963 p 62–79 refs (See N64-12486 04-07) OTS: $8.10

The possibility of chloromethylation of organosilicon compounds was demonstrated using trialkylbenzylsilane as an example. Depending on the conditions, chloromethylation of trialkylbenzylsilanes leads to parisomeric and orthoisomeric chloromethyl derivatives. A number of oxygen-containing organosilicon compounds and silicon-hydrocarbons were obtained from chloromethylbenzyltrialkylsilanes. From chloromethylalkylbenzenes obtained by chloromethylation of toluene, ethyl, and isopropylbenzines, organosilicon compounds with alkylbenzyl radicals attached to the silicon atom were synthesized and described.

R.T.K.

N64-12495 Joint Publications Research Service, Washington, D.C.

RADICALS – PRODUCTS OF THE THERMAL DECOMPOSITION OF SUBSTITUTED CYCLOHEXADIENEONE PEROXIDE

V. D. Pokhodenko and L. N. Ganyuk *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 8–11 refs (See N64-12493 04-01) OTS: $1.00

Bis-(1,3,4-tri-*tert*-butylcyclohexadiene)-2,5-one-4-peroxide decomposes according to a homolytic mechanism, with the formation of a stable radical. The mechanism of the decomposition can be represented in the following manner: Homolytic cleavage of the comparatively weak O—O bond occurs first. The radical formed thereby then disproportionates, with a transfer of one-*tert*-butyl group to the peroxide oxygen, giving a substituted benzoquinone and a phenoxy radical. The latter, by removing a hydrogen from a second *tert*-butyl radical, gives a phenol and isobutylene which are found in the decomposition products. I.v.L.

N64-12578 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Materials Lab.
THE DETERMINATION OF TRACE AMOUNTS OF BORON IN MOLYBDENUM Technical Documentary Report [Jun. 1962-Jul. 1963]
K. F. Sugawara Nov. 1963 16 p refs
(RTD-TDR-63-4082; AD-425811)

A reliable method has been established for the determination of 1 to 25 μg of boron in molybdenum. Dissolution of the metal is effected with a fusion mixture of sodium carbonate and sodium nitrate. The boron is selectively separated by distillation and then determined spectrophotometrically, using carminic acid reagent. In addition, a study was completed to determine the most efficient manner in which the distillation can be accomplished. The sensitivity is approximately 20 ppm boron in molybdenum, but the sensitivity can be extended by using larger samples. Author

N64-12581 Aerospace Corp., El Segundo, Calif. Labs. Div.
THE PHOTOLYSIS AND PYROLYSIS OF 4-METHYL-4-METHOXY-2-PENTANONE
D. J. Coyle, R. V. Peterson, and Julian Heicklen 4 Nov. 1963 28 p refs
(Contract AF 04(695)-269)
(TDR-269(4240-20)-1; SSD-TDR-63-289; AD-425590)

The photolysis of 4-methyl-4-methoxy-2-pentanone yields mesityl oxide, methanol, and a hydroxy furan derivative. Small amounts of acetone and methyl isopropenyl ether are formed also. The ratios of products are not affected by the extent of conversion, the temperature, or the addition of oxygen, and are only slightly affected by altering the solvent. Mesityl oxide and methanol are formed in both photolysis and pyrolysis. In both cases, reaction probably occurs from excited vibrational levels of the ground electronic state through a four-member ring intermediate. In the photolysis, all of the radiation is absorbed. Since one of the products, mesityl oxide, also absorbs in the same region as the reactant, it inhibits the photolysis by removing some of the incident radiation. In the pyrolysis, no such inhibition takes place. Author

N64-12603 Army Missile Command, Huntsville, Ala.
ON HYDRAZOIC ACID (AZOIMIDE), HN_3
T. Curtius 31 Oct. 1963 14 p refs Transl. into ENGLISH from Chem. Ber., v. 23, p 3023-3033
(RSIC-94; AD-423891)

Several methods are presented for the formation of hydrazoic acid (azoimide), HN_3, and the physical and chemical properties of this acid are discussed. J.E.T.

N64-12604 Army Missile Command, Huntsville, Ala.
ON THE HYDROLYSIS OF 1, 2, 4, 5-TETRAZINE-3, 6-DICARBOXYLIC ACID
T. Curtius, August Darapsky, and Ernst Müller 1 Nov. 1963 22 p refs Transl. into ENGLISH from Chem. Ber., v. 40, 1907 p 1176-1193
(RSIC-95; AD-423892)

Experiments described are: (1) the preparation of tetrazinedicarboxylic acid; (2) the decomposition of tetrazinedicarboxylic acid by boiling with water or dilute sulfuric acid; (3) the determination of the hydrazine contained in the acid hydrazine salt of glyoxyl-hydrazinooxalic acid as diammonium; (4) the hydrolysis of benzalhydrazinooxalic acid; (5) the synthesis of the acid hydrazine salt of glyoxyl-hydrazinooxalic acid from hydrazinooxalic acid, glyoxylic acid, and hydrazine; and (6) tetrazine dicarboxylic acid derived from the acid hydrazine salt of bisdiazo-acetic acid. J.E.T.

N64-12605 Army Missile Command, Huntsville, Ala.
ON SEMI-OXAMAZIDE
Wilhelm Kerp and Karl Unger 1 Nov. 1963 12 p refs Transl. into ENGLISH from Chem. Ber., no. 30, 1897 p 586-593
(RSIC-96; AD-423961)

Semioxamazide, a mixed amide-hydrazide of oxalic acid, has been prepared by the reaction of hydrazine and oxamic acid. This substance has been tested as a substitute for some isomeric modifications of semicarbazone which impair its usefulness in the separation of certain ketones and aldehydes. Most of the desired results have not been achieved. The semioxamazones of both aldehydes and ketones that were prepared exhibited even melting points, and the aldehyde derivatives form readily and in a quantitative yield. However, the reaction of the ketones proceeds in an uneven manner. Some ketones enter reaction only with difficulty and under very definite conditions. J.E.T.

N64-12699 Joint Publications Research Service, Washington, D.C.
A CHEMICAL CODE FOR SEARCHING SPECTROCHEMICAL INFORMATION
V. T. Aleksanyan, Z. B. Barinova, G. E. Vleduts, and L. A. Shevyakova *In its* Foreign Develop. in Machine Transl. and Inform. Process., no. 147 23 Dec. 1963 p 1-12 refs (See N64-12698 04-01) OTS: $2.25

An information searching system is described for the field of spectrochemical data, using punched card decks. The chemical code used in this system is described. It is based on a statistical analysis of the occurrence of various structural characteristics. Author

N64-12719* National Aeronautics and Space Administration, Washington, D.C.
DETERMINING THE MOLECULAR WEIGHT OF POLYETHYLENETEREPHTHALATE FROM THE TERMINAL RADICALS [OPREDELENIYE MOLEKULYARNOGO VESA POLIETILENTEREFTALATA PO KONTSEVYM GRUPPAM]
S. P. Matveyeva and V. A. Myagkov Jan. 1964 10 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 5, 1959 p 18-21
(NASA TT F-191) OTS: $0.50

The article treats: (1) the development and perfection of the methods for the quantitative determination of terminal groups in PET (polyethyleneterephthalate) and (2) the determination of the quantitative content of OH and COOH radicals in PET with a different molecular weight, at various stages of its preparation and conversion to fibers. Author

N64-12723 Joint Publications Research Service, Washington, D.C.
EPR STUDY OF SENSITIZATION OF THE ALCOHOL DEHYDRATION PHOTOREACTION AT 77°K
V. Ye. Kholmogorov, E. V. Baranov, and A. N. Terenin *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow, v. 149] no. 1, 1963 12 Jul. 1963 p 1–7 refs (See N64-12722 04-01) OTS: $1.00

Results of a detailed study of the abundant formation of alcohol radicals, under the influence of ultraviolet radiation of wavelengths 334 mμ or longer, in solutions of analine, diphenylamine, triphenylamine, carbazole, fluorene, and naphthalene in methanol, ethanol, isopropanol, N-butanol, and isobutanol, at 77° and 90° K are reported. Electron paramagnetic resonance (EPR) spectra were determined for each sample after irradiation with a SVDSh-250 super high pressure mercury-vapor lamp with appropriate filters. All the solutions studied showed intense fluorescence when irradiated at 77° K, which suggests that the reaction of alcohol photodehydration is associated with the excitation of the singlet level of the amine or carbazole molecule. Further experiments in which the triplet state of triphenylamine or carbazole was selectively deactivated by napthalene suggest that the dehydration of alcohols occurs from molecules of aromatic amines and carbazole in the triplet state. Further parallel measurements should clarify the relative parts played by the singlet and triplet states in such reactions. M.P.G.

N64-12805 Joint Publications Research Service, Washington, D.C.
POLYMERS WITH INORGANIC MAIN CHAINS
Kuz'ma Andrianovich Andrianov 22 Jul. 1963 670 p refs Transl. into ENGLISH of the book "Polimery s neorganicheskimi glavnymi tsepyami molekul", Moscow, Izd. AN SSSR, 1962 327 p
(JPRS-20272; OTS-63-31341) OTS: $7.75

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1. REACTIONS FOR FORMATION OF HIGH-MOLECULAR COMPOUNDS WITH INORGANIC MOLECULAR CHAINS K. A. Andrianov p 10–62 refs (See N64-12806 04-07)
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N64-12806 Joint Publications Research Service, Washington, D.C.
REACTIONS FOR FORMATION OF HIGH-MOLECULAR COMPOUNDS WITH INORGANIC MOLECULAR CHAINS
Kuz'ma Andrianovich Andrianov *In its* Polymers with Inorganic Main Chains 22 Jul. 1963 p 10–62 refs (See N64-12805 04-07) OTS: $7.75

The processes of the formation of high-molecular element (inorganic)–organic compounds are based on hydrolytic polycondensation reactions, double decomposition reactions, and heterofunctional polycondensation reactions. The aminolysis reaction of various element-organic compounds is of great importance to the synthesis of polymers containing element-nitrogen bonds. In all of the above reactions, inorganic cyclic radicals, framed by organic groups, are formed often in large amounts, in addition to the high-molecular element-organic compounds. Because of this, the reactions of polymerization of inorganic cyclic compounds, with the formation of oligomers, and the reactions of polycondensation of oligomers into high-molecular element-organic compounds are of great importance to the synthesis of element-organic high-molecular compounds. In this report, the above types of reactions are discussed. I.v.L.

N64-12807 Joint Publications Research Service, Washington, D.C.
CHEMICAL COMPOSITION, STRUCTURE AND PROPERTIES OF POLYMERS WITH INORGANIC MOLECULAR CHAINS
Kuz'ma Andrianovich Andrianov *In its* Polymers with Inorganic Main Chains 22 Jul. 1963 p 63–147 refs (See N64-12805 04-07) OTS: $7.75

This review of polyorganosiloxanes presents discussions on the following: (1) general problems of stability—thermal, thermo-oxidative, and hydrolytic; (2) the thermo-oxidative destruction of polymers in powder form; (3) the thermo-oxidative destruction of polymers in films; (4) differential thermal analysis; (5) electrical properties; and (6) mechanical properties. Also, the structure, properties, and hydrolytic stability of polyorganometallic siloxanes are discussed. I.v.L.

N64-12808 Joint Publications Research Service, Washington, D.C.
METHODS FOR OBTAINING POLYORGANOSILOXANES
Kuz'ma Andrianovich Andrianov *In its* Polymers with Inorganic Main Chains 22 Jul. 1963 p 148–465 refs (See N64-12805 04-07) OTS: $7.75

Five methods for the preparation of polyorganosiloxanes are discussed. These methods are: (1) hydrolytic polycondensation; (2) heterofunctional polycondensation; (3) exchange decomposition reactions; (4) catalytic polymerizations of rings; and (5) the reaction of silicon organic monomers with acids, aldehydes, and ketones. In addition, the properties of polymers prepared by the above methods are discussed. Also, a method for preparing polyorganosilazanes is presented. I.v.L.

N64-12809 Joint Publications Research Service, Washington, D.C.
POLYELEMENTALORGANOSILOXANES
Kuz'ma Andrianovich Andrianov *In its* Polymers with Inorganic Main Chains 22 Jul. 1963 p 465a–574 refs (See N64-12805 04-07) OTS: $7.75

The structure, preparation, and properties of the following are discussed: (1) polyaluminoorganosiloxanes; (2) polyboroorganosiloxanes; (3) polytitanoorganosiloxanes; (4) polystannoorganosiloxanes; (5) polygermanoorganosiloxanes; (6) polyplumboorganosiloxanes; (7) polyphosphoroorganosiloxanes; (8) polybismuthoorganosiloxanes; (9) polyantimonialorganosiloxanes; (10) polyvanadoorganosiloxanes; (11) polycobaltoorganosiloxanes; and (12) polynickeloorganosiloxanes. I.v.L.

N64-12810 Joint Publications Research Service, Washington, D.C.
POLYORGANOELEMENTALOXANES
Kuz'ma Andrianovich Andrianov *In its* Polymers with Inorganic Main Chains 22 Jul. 1963 p 575–664 refs (See N64-12805 04-07) OTS: $7.75

The polyorganoelementaloxanes are a large group of polymers which have molecular chains made up of atoms of oxygen and of other inorganic elements. This report discusses the preparation and properties of the following: (1) polyorganoaluminooxanes and polyorganosiloxanoaluminooxanes; (2) polyorganoborooxanes; (3) polyorganotitanooxanes; (4) polyorganogermanooxanes; and (5) polyorganophosphoroelementaloxanes. Also, polymers containing boron and nitrogen, phosphoramide and phosphinamide polymers, and arsenoorganic polymers are discussed. I.v.L.

N64-12816 Borden Chemical Co., Philadelphia, Pa. Central Research Lab.
REINFORCED HIGH TEMPERATURE ELASTOMERS Quarterly Progress Report No. 2, 1 Jan.-31 Mar. 1963
K. C. Tsou, S. J. Makower, R. N. Goldey, and B. D. Halpern [1963] 35 p refs
(Contract DA-36-034-AMC-3791-W)
(AD-405893) OTS: $3.60

A comparison of trimethylsilyl and triphenylsilyl modified silicas indicates that the trimethylsilyl modified filler is more suitable for higher tensility at high temperature without sacrificing room temperature tensile and elastic properties. A comprehensive study has been carried out with various nonreinforcing fillers to determine their relative usefulness for improving high temperature performance. Asbestine 3-X, a fibrous grade of talc, was chosen as the best nonreinforcing filler to obtain high tensility at 500° F after aging at the same temperature. Author

N64-12832 Naval Research Lab., Washington, D.C.
THE SOLUBILITY OF ALKALI-METAL DINONYLNAPHTHALENE SULFONATES IN VARIOUS TYPES OF SOLVENT, AND A THEORY FOR THE SOLUBILITY OF OIL-SOLUBLE SOAPS
R. C. Little and C. R. Singleterry 11 Nov. 1963 26 p refs
(NRL-6010; AD-424577)

The solubility of the alkali-metal (group I) dinonylnaphthalene sulfonates in low-polarity solvents is roughly parallel to that of dinonylnaphthalene in the same solvents. This indicates that, to a first approximation, the outer hydrocarbon sheath of the micelle determines compatibility with a solvent. The solubility behavior in nonpolar solvents is most readily correlated by comparison of the Hildebrand solubility parameter of the solvent with that estimated for the hydrocarbon exterior of the micelle. In systems showing limited solubility, the data indicate that (1) the condensed soap phase behaves as an extremely viscous liquid and (2) the equilibrium is characteristic of a liquid/liquid system in which the limited solubility of the two components in each other increases with rising temperature to a critical solution temperature; above this temperature, the soap and solvent are miscible in all proportions. For ordinary oil-soluble soaps in common hydrocarbons, the critical solution temperature lies well below room temperature. Author

N64-12866 Aeronutronic, Newport Beach, Calif.
CHEMICAL CORROSION OF ROCKET LINER MATERIALS AND PROPELLANT PERFORMANCE STUDIES. THERMODYNAMIC PROPERTIES OF HEAVY METAL SPECIES, VOLUME TWO OF TWO Final Technical Report
R. W. Sprague 15 Dec. 1963 96 p refs
(Contract NOw-61-0905-c; ARPA Order 22-62)
(U-2384; AD-425887)

Computations of the chemical equilibria between rocket-liner materials and corrosive gaseous or condensed materials are presented in tabular form. Temperature ranges examined were from 298.15° to 6000° K for individual species of tantalum, tungsten, and hafnium. J.E.T.

N64-12868 Purdue U., Lafayette, Ind.
RESEARCH IN NITROMONOMERS AND THEIR APPLICATION TO SOLID SMOKELESS PROPELLANTS Annual Progress Report No. 25, 15 Sep. 1962-14 Sep. 1963
Henry Feuer 30 Nov. 1963 74 p refs
(Contract Nonr-1100 (13))
(Res. Rept. 25; AD-426102)

The scope and synthetic utility of the alkyl nitrate nitration have been further advanced by the successful application of the reaction to the preparation of α-mononitroketones; the cleavage reaction which takes place during the alkyl nitrate nitration has been investigated extensively; study of the ring-opening reaction of salts of cyclic α, α-dinitroketones has been continued; and the reactions of lithium cyclohexanenitrate, lithium 2-butanenitronate, and potassium 1-heptanenitronate with diborane were studied. C.L.W.

N64-12921 Army Missile Command, Huntsville, Ala.
EFFECT OF CARBONYLAZIDE, CON_6, ON AROMATIC HYDROCARBONS
T. Curtius and A. Bertho 31 Oct. 1963 33 p refs Transl. into ENGLISH by JPRS from Chem. Ber., v. 59B, 1962 p 565-589
(RSIC-93; AD-423768)

The behavior of carbonylazide, CON_6, toward benzene, toluene, p-xylene, and p-cymene was investigated. Experiments described include preparation of carbazide–hydrocarbon solutions, decomposition of carbazide in p-xylene, benzene, and toluene while under pressure, and decomposition of carbazide without pressure. J.E.T.

N64-12945* Yale U., New Haven, Conn. School of Medicine
USE OF XENON AND KRYPTON AS CARRIER GASES FOR A HIGHLY SENSITIVE DETECTION SYSTEM FOR GAS CHROMATOGRAPHY
S. R. Lipsky and M. M. Shahin Repr. from Nature (London), v. 200, 1963 p 566 refs
(NASA Grant NsG-192-61; Natl. Heart Inst. Grant He G-03558-06)

This report deals with a new and highly sensitive ionization system for the detection of permanent gases and organic vapors by gas chromatography. When only monoatomic carrier gases (either argon, krypton, or xenon) flow within the ionization chamber, the free electrons engage in elastic collisions with the particular monoatomic gas atoms. In this case, the electron drift velocity in these rare gases is relatively low. Thus, under these conditions, in an applied field, the electron temperature is increased considerably above that of the gas, making collection at the anode relatively inefficient. This would account for the lack of a distinct sensitivity maximum and the comparatively poor response (minimal level of detection less than 3×10^{-8} mole/sec at a flow rate of 25 ml/min of carrier gas) which was observed when test samples of the various monoatomic gases such as argon, krypton, and xenon were introduced into the system already containing different monoatomic carrier gases. I.v.L.

N64-13015 Hanford Atomic Products Operation, Richland, Wash.
IRRADIATION EFFECTS IN URANIUM DIOXIDE SINGLE CRYSTAL

J. L. Bates, J. A. Christensen, and J. L. Daniel Sep. 1962 26 p refs
(Contract AT(45-1)-1350)
(HW-73959) OTS: $0.75

The effect of irradiation on single crystal UO_2 at exposures up to 1.44 x 10^{20} fissions/cm^3 and at temperatures less than 400° C was investigated. The studies included measurements of gas release, lattice parameter, microstructure, hardness, and melting point. Author

N64-13018 Hanford Atomic Products Operation, Richland, Wash.
HOT SEMIWORKS STRONTIUM-90 RECOVERY PROGRAM
M. D. Alford et al 17 Jul. 1963 178 p refs
(Contract AT(45-1)-1350)
(HW-72666) OTS: $2.75

This report describes the laboratory studies, radioactively cold development studies, and radioactively hot development-recovery activities involved in the hot semiworks operations to recover Sr^{90} for use in thermoelectric power units. Details are presented on the D2EHPA (di-2-ethylhexyl phosphoric acid) extraction process successfully used in the hot semiworks operations and on the development studies on solvent extraction, ion exchange, and precipitation leading to the recovery and purification of nearly a megacurie of Sr^{90}. I.v.L.

N64-13026 Joint Publications Research Service, Washington, D.C.
CYBERNETICS IN CHEMISTRY
V. Kafarov 8 Jan. 1964 7 p Transl. into ENGLISH of an article from Pravda (Moscow), no. 286, 13 Oct. 1963 p 2
(JPRS-22645; OTS-64-21228)

The application, in the U.S.S.R., of cybernetics to the chemical industry is discussed. The calculation of the work regime of technological equipment for a given composition of a gas, in the methane-processing shop at the Rustavi Nitrogen-Fertilizer Plant, is being conducted with the assistance of a computer. A system of operative control over ammonia production by an "autodispatcher" computer is working at the Chemical Combine in Lisichansk. The computer controls the expenditure of raw material, water, steam, and energy, distributes the loads among the units, and determines their breakdown condition and maximum loads. Workers of the Institute of Catalysis at the Siberian Department of the Academy of Sciences, jointly with The State Institute for Designing Enterprises of the Basic Chemical Industry, utilized the principle of mathematical modeling in the calculation of the contact apparatus for sulfuric acid factories. As a result, they succeeded in considerably lowering the expenditure of the catalytic agent at a fixed degree of conversion. However, little attention is devoted to cybernetics in the U.S.S.R., and only 8 percent of the total number of specialists are engaged in cybernetics and automation research. I.v.L.

N64-13060* Southern Research Inst., Birmingham, Ala.
A STUDY OF POLYMERS CONTAINING SILICON-NITROGEN BONDS Progress Report, 4 Nov.-3 Dec. 1963
Robert E. Burks, Jr., and Thomas W. Ray 19 Dec. 1963 24 p
(NASA Contract NAS8-1510)
(NASA CR-51595; Rept. 34) OTS: $2.60 ph, $0.92 mf

Aluminum ethoxide was found to catalyze the polymerization of bis(methylamino)diphenylsilane. The mechanism of polymerization is not understood, but it appears that the silicon-nitrogen bond is weakened by the presence of the aluminum compound with resulting condensation by elimination of methylamine. A silylamine made from methylphenyldichlorosilane and methylamine reacted with dihydroxybenzenes to form polymers that were flexible and had good thermal stability. Attempts to induce ethoxysilanes to react with silylamines were not successful. Ammonium chloride and diphenyldichlorosilane were tried as catalysts, but polymers were not produced. Silicon-nitrogen polymers with phenylene groups in the chain were studied further. Author

N64-13077 Harshaw Chemical Co., Cleveland, Ohio
INVESTIGATION OF THE EXISTENCE OF OXYANIONS OF FLUORINE AND NITROGEN AND THE NITROGEN-FLUORINE CATIONS Quarterly Technical Summary Report, 28 Jul.-28 Oct. 1963
H. J. Bronaugh and S. I. Khayat 21 Nov. 1963 11 p refs
(Contract DA-31-124-ARO(D)-76; ARPA Order 402)
(HQ-76-3; AD-423918)

Data are presented for seventeen experiments concerned with the hydrolysis of nitrogen trifluoride. Numerical analysis of these results supports the postulated equation $NF_3 + 4NaOH \rightarrow 3NaF + NaNO_2 + 2H_2O$. Author

N64-13114 Emmanuel Coll., Boston, Mass. Research Language Center
ORGANIC COMPLEXES WITH CHARGE MIGRATION [ORGANICHESKIE KOMPLEKSY S PERENOSOM ZARIADA]
V. P. Parini Bedford, Mass., Office of Aerospace Research, Apr. 1963 41 p refs Transl. into ENGLISH from Usp. Khim., v. 32, no. 7, 1962 p 822-837
(Contract AF 19(604)-8505)
(ETR-63-3; AD-412908)

An investigation of the electrical conductivity of charge migration complexes (CMC) and of the magnetic properties connected with it is discussed. The following topics are discussed in particular: (1) the nature of charge migration complexes; (2) donors; (3) acceptors; (4) research methods and certain CMC properties—optical investigation of CMC, investigation of the magnetic properties of CMC, and investigations of the electroconductivity of CMC; and (5) CMC and the mechanism of chemical reactions. P.V.E.

N64-13160* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
RUPTURE BEHAVIOR OF ELASTOMERS: EFFECT OF STATISTICAL VARIABILITY AND CROSSLINK DENSITY
R. F. Landel and R. F. Fedors Repr. from J. Polymer Sci., Pt. B: Polymer Letters, v. 1, Oct. 1963 p 539-544 refs
(NASA Contract NAS7-100)
(NASA CR-55213; JPL-TR-32-468)

An investigation of the effects of statistical distribution of break properties on the resolution of a failure envelope and of the effects of changing the crosslink density on its shape and located in the log σ_b, log ϵ_b plane is discussed (σ_b is the tensile strength based on the original cross-sectional area and ϵ_b is the rupture strain). It is concluded that the relative concentration of network chains in samples of a given rubber type can be rapidly and conveniently determined by strain testing multiple samples at one rate and at a suitable temperature. The vertical separation of the curves corresponds then to the logarithm of the relative concentrations of chains. If the concentration is known for one sample, the values for the other samples can be determined absolutely. Conversely, a portion of the reduced failure envelope can be generated by testing multiple samples of a polymer having varying crosslink densities at one rate and at one temperature. P.V.E.

N64-13216 California U., Berkeley. Lawrence Radiation Lab.
VAPORIZATION OF IRON OXIDES
Charles A. Washburn (M.S. Thesis) Aug. 1963 26 p refs
(Contract W-7405-eng-48)
(UCRL-10991) OTS: $0.50

The vapor species in equilibrium with iron oxide samples of compositions between $FeO_{1.1}$ and $FeO_{1.33}$ were studied with a mass spectrometer in the temperature range 1500° to 1594° C. The molecules O, O_2, Fe, and FeO, and only these molecules, were observed over the entire composition and temperature range. The existence of $(FeO)_{3(g)}$ or $Fe_3O_{4(g)}$, which was recently claimed from the interpretation of vapor density experiments, appears to have been disproved. At 1594° C the pressure of $FeO_{(g)}$ in equilibrium with the congruently vaporizing composition is approximately one-third the pressure of $Fe_{(g)}$. Author

N64-13219 California U., Berkeley. Lawrence Radiation Lab.
A STUDY OF THE REACTIONS BETWEEN GASEOUS AMMONIA AND SULFUR CHLORIDES
Milagros Villena-Blanco (M.S. Thesis) 21 Oct. 1963 39 p refs
(Contract W-7405-eng-48)
(UCRL-11081) OTS: $0.75

The reaction between gaseous ammonia and sulfur chlorides (S_2Cl_2 and SCl_2) has been studied under various conditions of temperature, flowrate of ammonia, concentration and type of sulfur chloride, solvent, and duration of run, for the purpose of determining the optimum conditions for the preparation of S_4N_4 and S_7NH. Adsorption-column chromatography on alumina and silica gel columns was employed for the quantitative separation of the reaction products. Author

N64-13257 Humble Oil and Refining Co., Baytown, Tex.
REACTIONS OF GASEOUS IONS 14. HIGH PRESSURE MASS SPECTROMETRIC STUDY OF ALKANES
M.S. B. Munson, J. L. Franklin, and F. H. Field Charlottesville, Va. School of Eng. and Appl. Sci. Nov. 1963 58 p refs
Submitted for Publication
(Contract Nonr 3623(00); Proj. Squid)
(HUM-TR-4-P; AD-426210)

Mass spectra and ion-molecule reactions have been studied in ethane, propane, and the butanes at source pressures up to 150μ. In all four compounds the most important reactions involve hydride transfer leading to the formation of the formation of the $C_nH_{2n+1}^+$ ion. With propane and the butanes this ion increases to 40% to 60% of the total ionization above 100μ pressure. With propane and butane the next most important reaction involves the transfer of H_2^- to form $C_nH_{2n}^+$. $C_2H_7^+$ in small concentrations was observed in ethane, and its precursor was deduced to be an excited ethane ion. Rate constants for a number of reactions have been determined. Primary ions formed with excess kinetic energy exhibit anomalous rate behavior. Several collision-induced metastable transitions occur with all four compounds. Author

N64-13293 California U., Berkeley. Lawrence Radiation Lab.
KINETICS OF AROMATIC NITRATION
Reid Clark Miller and Theodore Vermeulen 15 Oct. 1963 60 p refs
(Contract W-7405-eng-48)
(UCRL-11069) OTS: $1.50

Heterogeneous nitration rates of the aromatic organic compound 1,3-bis(trifluoromethyl)benzene in a well-agitated batch system have been measured in an extensive range of very concentrated mixed acids (aqueous HNO_3 and H_2SO_4), with each run at essentially constant acid composition. The observed conversions correlated well with a first-order dependence on the fraction of aromatic unconverted. Solubilities of the aromatic compound have been measured over the range of acid compositions. By eliminating solubility from the kinetic results, the apparent rate coefficient along the H_2SO_4-H_2O base line is found to have a maximum value near 92 weight-percent H_2SO_4. The coefficient also exhibits a maximum on the HNO_3-H_2SO_4 base line at approximately 55 weight-percent H_2SO_4. The nitration rates are correlated in a manner that indicates, at any given mixed-acid composition, (1) the nonideality of the reaction medium expressed by the activity-coefficient behavior, and (2) the ability of the medium to convert HNO_3 to NO_2^+, the attacking species in the nitration sequence. Author

N64-13310 Hercules Powder Co., Wilmington, Del.
A STUDY OF THE ELECTRONIC CONFIGURATION AND BEHAVIOR OF THE $-NF_2$ GROUP Quarterly Report, No. 3, Sep.-Nov. 1963
A. D. Craig et al 16 Dec. 1963 54 p refs
(Contract DA-31-124-ARO(D)-62; ARPA Order 402)
(AD-425473)

The interrelation of results from the areas of electrochemistry, spectroscopy, and complexation, and theoretical calculations in an investigation of the electronic configuration and behavior of the $-NF_2$ group are beginning to give a general picture of the chemistry of various NF species. Work to date indicates that the NF-containing ions which have the greatest probability of long-term existence are the cations. Insight has been gained into the preparation of NF_2 cations by oxidation of simple NF_2 compounds, by establishing the mechanism of oxidation of HNF_2 to $\cdot NF_2$ through electrochemical studies. Complex formation was studied to determine its effects on bonding in simple NF_2 compounds. HNF_2 complexes and CH_3NF_2 complexes were investigated along with NF_2 cations and anions in low-temperature solids. Through theoretical calculations it was found that in $\cdot NF_2$, NF_2-, and NF_2+ the nonbonding L-shell electrons of the nitrogen are more probably located on the fluorines than on the nitrogen. C.L.W.

N64-13313 Tracor, Inc., Austin, Tex.
ELECTROCHEMICAL STUDIES IN THE SYNTHESIS OF N-F COMPOUNDS Quarterly Status Report No. 3, 1 Jul.-30 Sep. 1963
Robert R. Annand 20 Nov. 1963 28 p refs
(Contract Nonr-4054(00); ARPA Order 399)
(TRACOR 63-278-U; AD-426223)

The work reported here has been primarily devoted to seeking more reproducible passivation of aluminum electrodes. On the basis of previous work, aluminum was selected as a metal which came close to exhibiting the desired passive behavior in AHF similar to ferrous materials in aqueous systems. Data are reported concerning the reliability of the platinum base electrode, and describing the complex behavior of the Al/AlF_3/AHF/supporting electrolyte system. These data lead to the conclusion that the aluminum behavior is more like that of the valve metals (e.g., tantalum) than that of passivating materials in aqueous systems. Author

N64-13368 Atomic Energy Commission, Idaho Falls, Idaho
ECONOMICS OF HYDROCRACKING DAMAGED COOLANT FROM ORGANIC REACTORS
J. L. Griffith and G. J. Russell Nov. 1963 58 p refs
(IDO-11400) OTS: $1.25

The hydrocracker concept is capable of resolving several important technical and economic problems associated with organic coolants. The unit reconstitutes damaged organic coolant, maintains the coolant material in a clean condition which substantially reduces fuel element fouling, and allows coolant makeup cost to be greatly reduced. The report describes the advantages of installing several types of hydrocrackers on the Piqua Nuclear Power Facility and recommends a flash tank fed unit. Included is a brief economic study of a flash tank fed hydrocracker for a 500 Mwe organic-cooled heavy-water moderated reactor. Author

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-12457 Joint Publications Research Service, Washington, D.C.

CONCERNING THE GREATEST AMOUNT OF INFORMATION FROM A SOURCE WHICH IS BEING REMOVED WHEN FLUCTUATION NOISES ARE PRESENT IN A RECEIVER WITH A UNIFORM FREQUENCY SPECTRUM

V. I. Siforov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, No. 4, 1963 11 Dec. 1963 p 115–119 refs (See N64-12451 04-01) OTS: $5.00

It is proved that, when using any wide frequency band for the information transmission channel during the course of an unlimited time, the total amount of information received is finite. An approximate expression for the largest amount of information is found. Author

N64-12503 Joint Publications Research Service, Washington, D.C.

A COHERENT RADIO RECEIVER FOR RECORDING THE DIFFERENCE IN THE DOPPLER SHIFT IN THE FREQUENCY OF RADIO WAVES TRANSMITTED FROM ARTIFICIAL EARTH SATELLITES

Ya. L. Al'pert, V. B. Belyanskiy, and A. F. Kutyakov *In its* Transl. from Geomagnetizm i Aeronomiya [Moscow, v. 3] no. 1, 1963 7 May 1963 p 28–50 refs (See N64-12501 04-01) OTS: $1.50

The apparatus used to receive and record the difference in the Doppler frequency shift of coherent radio waves transmitted from artificial satellites is described in detail. The apparatus includes a special type of phase displacement recorder in addition to a coherent radio receiver. The amplitudes of all received waves are recorded, using separate receivers and recorders with separate tape speeds (from 0.5 mm/s to 1 m/s) simultaneously with measurements of the Doppler shift in frequencies. When required, the received signals can be recorded on magnetic tape for field-intensity analysis. Results of tests of the apparatus show that its sensitivity and accuracy permit detailed investigations of ionospheric parameters. M.P.G.

N64-12584 General Electric Co., Schenectady, N.Y. Advanced Technology Labs.

ULTRA HIGH POWER TRANSMISSION LINE TECHNIQUES [Quarterly Progress Report No. 1, Apr. 1-Jul. 1, 1963]

John P. Quine Griffiss AFB, N.Y., Techniques Lab. Oct. 1963 32 p refs

(Contract AF 30(602)-2990)

(RADC-TDR-63-342; AD-425601)

The purpose of this investigation is to develop systematic procedures for selecting optimum waveguide configurations and designing waveguide components that will operate at high levels of peak and average power in the frequency range 1 to 10 Gc. In particular, the feasibility will be investigated of designing compact components, such as bends, couplers, power dividers, tapers, and mode absorbers in waveguides having cross-section dimensions in the range 1.5 to 2.5 free space wavelengths. The present report reviews the program objectives and presents theoretical results for waveguide bends. Author

N64-12585 Sylvania Electric Products, Inc., Williamsville, N.Y.

ELECTRONICALLY STEERABLE ARRAY FOR SPACE VEHICLE APPLICATIONS

Edward J. Christopher Griffiss AFB, N.Y. Techniques Lab. Nov. 1963 77 p refs

(Contract AF 30(602)-3041)

(RADC-TDR-63-344; AD-425478)

The purpose of this investigation is to determine the feasibility of designing and constructing a high gain, broadband, inertialess scanned array at millimeter frequencies (30 to 100 Gc). Collimating techniques are studied to determine most effective wide-angle scanning aperture. Results show that a spherical minor or Luneberg lens will give scan angles in excess of ± 45 degrees. Coherent scattering is investigated in order to relieve the limitations of the Abbe sine condition. Small (less than $\lambda/2$ in size) conducting and dielectric spheres along with small dipoles are investigated as scattering elements. Analog steering techniques are investigated including plasmas, ferroelectrics, and ferromagnetics as methods for altering the phase of an electromagnetic wave. Author

N64-12586 Electronic Communications, Inc., Timonium, Md. Research Div.

EXPERIMENTAL PROGRAM OF STEERABLE ANTENNA FOCUSING INVESTIGATION (STAFT). TWO-DIMENSIONAL SELF-FOCUSING ARRAY ANTENNA MODEL [Report No. 2, May 1-Jul. 31, 1963]

Charles L. Pankiewicz Griffiss AFB, N.Y. Tech. Lab. Nov. 1963 120 p refs

(Contract AF 30(602)-2930)

(RADC-TDR-63-418; AD-425400)

The field probing system was completed and put into operation. Initial trial runs were made to determine the characteristics of the equipment, and, as a result, several refinements were added to improve undesirable operation features. The first group of tests involved the collection of Fresnel zone radiation data for the square aperture array in programed and self-focusing modes of operation for a point focus. Patterns are included for mills cross and compact array arrangements as well as the patterns for a two-dimensional Chebyshev amplitude taper. The effects of antenna element factor on the radiated field were also measured by direct substitution of larger horn elements. Author

N64-12588 Cutler-Hammer, Inc., Dear Park, N.Y. Airborne Instruments Lab.
MULTIMODE POWER MEASUREMENTS Final Report
D. S. Levinson, O. F. Hinckelmann, R. L. Sleven, and J. J. Taub Griffiss AFB, N.Y. Electromagnetic Vulnerability Lab., Nov. 1963 47 p refs
(Contract AF 30(602)-2927)
(RADC-TDR-63-433; AD-425563)

Further development of the multimode power measurement technique has been performed in the areas of (1) size reduction, (2) extension of frequency range, and (3) measurement of power absorbed by mismatched terminations. By reducing the transverse dimensions of the oversize waveguide from 3 times to 1.5 times those of standard-size waveguide, the overall equipment length was reduced from 146 to 81 in. with a resulting decrease in accuracy from ±1 to ±3 db. The one portion of the system requiring substantial development to extend the measurement capability to 16 Gc was the microwave commutator. A broadband 10 to 16 Gc commutator was fabricated and used in system tests. With the possibility of 38 modes propagating, power measurements were made at 15 Gc using the reduced size equipment with a maximum error of 2.2 db. A modification to the power measurement technique and equipment enables the measurement of power transmitted to mismatched terminations. With various mismatches, including a short circuit, the transmitted power has been measured with a maximum error of 2.9 db. Author

N64-12589 Syracuse U. Research Inst., N.Y.
SYNTHESIS TECHNIQUE FOR A CLASS OF LINEAR DATA-PROCESSING ANTENNA ARRAYS
Fung-I Tseng and David K. Cheng Griffiss AFB, N.Y. Techniques Lab. Nov. 1963 9 p refs
(Contract AF 30(602)-2646)
(RADC-TDR-63-437; AD-425403)

This report presents a technique for synthesizing linear, data-processing antenna arrays using wideband elements and a matched filter. It is shown that, for signals with a finite spectrum, such arrays will consist of a far less number of elements and have smaller overall dimensions than conventional arrays for single-frequency CW operation with similar radiation characteristics. The elements are, in general, unequally spaced, and the detailed design procedure depends upon the signal spectrum. Examples are included which demonstrate quite drastically the advantages of such data-processing arrays. Comparison with single-frequency Dolph–Chebyshev arrays emphasizes these advantages. Author

N64-12591 Illinois U., Urbana Electrical Engineering Research Lab.
STUDY AND INVESTIGATION OF MILLIMETER AND SUB-MILLIMETER WAVE RECEIVER TECHNIQUES Quarterly Report No. 2
J. E. Degenford, C. S. Kim, and E. Yamashita Griffiss AFB, N.Y. Electronic Warfare Lab. Nov. 1963 24 p refs
(Contract AF 30(602)-3046)
(RADC-TDR-63-458; AD-425356)

This program has as its goal the development of video detection techniques which are appropriate for the millimeter and submillimeter range of the spectrum. The pyroelectric detector has been successfully used to detect radiation at a wavelength of 0.845 mm. A technique for fabricating spheroidal reflectors from metal foil is described. Field distribution measurements for the beam waveguide have been made, and the results are in satisfactory agreement with the theory. Author

N64-12895* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PULSE-FREQUENCY-MODULATION TELEMETRY
Robert W. Rochelle (Ph.D. Thesis) Washington, NASA Jan. 1964 58 p refs
(NASA TR R-189) OTS: $1.50

This report is concerned with the heuristic development of the basic features of pulse-frequency modulation. The theory of group-coded binary sequences is derived by using a special type of correlation matrix. By combining particular sequences from a number of these correlation matrices, a new matrix is generated which is identical to the correlation matrices, a new matrix is generated which is identical to the correlation matrix of a set of pulse-frequency modulation words. Thus, it is shown that pulse-frequency modulation has the same communication efficiency as a comparable set of coded binary sequences with an equal number of quantized levels. In the detection process for PFM signals, a set of contiguous unmatched filters is used to enhance the signal-to-noise ratio. The analysis of the excitation of an unmatched filter to a step sinusoid is carried out to indicate the magnitude of the errors affecting the direct frequency measurement of the pulsed sine wave. Experimental results from the spectral analyses of satellite recordings perturbed with random noise are presented to illustrate the noise-immunity characteristic of pulse-frequency modulation. Author

N64-12728 Joint Publications Research Service, Washington, D.C.
CONCERNING THE PROPAGATION OF RADIO WAVES ALONG THE INHOMOGENEOUS EARTH'S SURFACE
A. N. Plemyannikov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 28–47 ref (See N64-12726 04-01) OTS: $4.00

A generalized method is presented for the calculation of the amplitude and phase of radio waves propagating along the flat inhomogeneous earth's surface. Plots are presented for the calculation of the modulus and argument of the attenuation function of an inhomogeneous profile consisting of two or three sections. Results are presented for the calculation of the modulus and argument of the attenuation function for specific examples of a flat profile consisting of two and three sections. Author

N64-12742 Joint Publications Research Service, Washington, D.C.
METHOD FOR IMPROVING THE REAL SELECTIVITY OF AM RECEIVERS
V. M. Shushin and A. P. Zelenin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 234–240 refs (See N64-12726 04-01) OTS: $4.00

A method is described for improving the real selectivity of radio receivers. The results of an investigation of receivers in which this method was employed are described as follows: Listening to real radiobroadcast station programs confirmed the high selectivity of the receiver. The neighboring stations were perceived only as a background of "metallic timbre," and there was no gain in the pulse noise. Among the shortcomings of the receiver, in addition to the complication of the circuit, were the increased requirements with respect to the heterodyne stability. In the case of heterodyne frequency drift, there was produced, first, asymmetry of the AM signal spectrum, leading to an increase in the nonlinear distortion, and second a decrease in the additional selectivity. R.T.K.

N64-12744 Joint Publications Research Service, Washington, D.C.
FORMATION OF MULTI-LOBE DIRECTIVITY PATTERNS WITH THE AID OF MODULATED SLOW-WAVE STRUCTURES
A. I. Gudzenko *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 247-251 refs (See N64-12726 04-01) OTS: $4.00

A multilobe directivity pattern in a surface-wave antenna was obtained by modulation of the impedance plane. The period of the modulating function and the variation of the amplitude of the impedance along the antenna were calculated independently for each lobe. The necessary ratios of the powers contained in the individual lobes were determined from the expression for the overall efficiency of the antenna. The calculation of the radiation of such an impedance-modulated surface was carried out by expanding the modulation function in a Fourier series and taking into account the radiation of each sinusoidal component. The results of an experimental investigation of a surface-wave antenna model with a two-lobe directivity pattern offered evidence of the advisability of using the superposition principle of the radiation of complex linear impedance structures. R.T.K.

N64-12746 Joint Publications Research Service, Washington, D.C.
FIRST APPLICATIONS OF RADIO IN GEODETIC WORK BEYOND THE POLAR CIRCLE, 1922-1924
B. A. Ostroumov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 260-269 (See N64-12726 04-01) OTS: $4.00

The developments in radio engineering that led to the solutions of geodetic and geographic problems in the region beyond the Arctic Circle are discussed. R.T.K.

N64-12854 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.
PERFORMANCE OF A SYNTHETIC-APERTURE MAPPING RADAR SYSTEM
Jean A. Develet, Jr. 18 Dec. 1963 33 p refs
(Contract AF 04(695)-269)
(TDR-269(9990)-2; SSD-TDR-63-365; AD-425919)

An ideal synthetic-aperture mapping radar system is postulated. The response of this system is then computed for (1) a point target, (2) locally homogeneous terrain, and (3) terrain of arbitrary reflectivity. Relationships for achievable resolution, swath width, and final map SNR versus the independent parameters of vehicle altitude, terrain scattering coefficient, carrier wavelength, vehicle velocity, and average radiated power are developed. The ideal system considered can be approximated in practice, for small real-antenna beamwidths, by using large time-bandwidth chirp waveforms and sin x/x illumination of the real-antenna aperture. Author

N64-12859 Mitre Corp., Bedford, Mass.
SEVERAL METHODS OF SOURCE SYNTHESIS FOR ANTENNAS
R. H. T. Bates Oct. 1963 35 p refs
(Contract AF 19(628)-2390)
(MTS-9; ESD-TDR-63-451; AD-422358)

Several methods are considered of synthesizing the aperture distribution for a specified far-field polar diagram. The majority of the solutions are given in the form of a finite number of linear, algebraic simultaneous equations and are therefore suitable for evaluation by digital computers. The treatment is divided into four groups: eigenvalue solution, discrete sources, continuous sources for the polar diagram expressed as an explicit function of angle, and continuous sources for the polar diagram expressed as an explicit function of the sine of the angle. The apparent physical significance of the analysis is mentioned where pertinent. Author

N64-12946* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
PFM SIMULATOR
Harold Levy, Paul Heffner, and Joseph Tinsley Sep. 1963 41 p
(NASA TM X-51336; NASA X-561-63-199) OTS: $4.60 ph, $1.43 mf

A Pulse Frequency Modulation (PFM) simulator, constructed to assist in the design and checkout of PFM equipment, is described. The specifications, operating instructions, description and theory of operation, circuits, and wiring and board locations are discussed. J.E.T.

N64-13053* National Aeronautics and Space Administration, Washington, D.C.
A PRACTICAL METHOD FOR DETERMINING THE DIRECTIVITY OF H. F. AND V. H. F ANTENNA SYSTEMS
C. S. L. Keay and R. E. Gray (Canterbury U.) Jan. 1964 20 p refs
(NASA Grant NsG-219-62)
(NASA TM X-940) OTS: $0.50

The radiation patterns of antenna systems operating at frequencies from 20 Mc to 500 Mc are readily measured by using a small self-contained transmitter and dipole suspended from a meteorological balloon. The balloon is tethered and controlled by four nylon lines which keep it at a constant distance from the center of the antenna. A complete pattern accurate to within 10 percent may be plotted in a few hours, depending on the working frequency and the amount of fine detail required. Author

N64-13191* Ohio State U. Research Foundation, Columbus Antenna Lab.
THE ADMITTANCE OF AN INFINITE SLOT RADIATING INTO A LOSSY HALF-SPACE
R. T. Compton, Jr. 15 Oct. 1963 22 p refs
(NASA Grant NsG-448)
(NASA CR-55141; Rept. 1691-2) OTS: $2.60 ph, $0.86 mf

The derivation for the admittance of an infinite slot radiating into a lossy half-space is presented. The slot is assumed to be an opening in an infinitely conducting ground sheet. Outside the slot there is a semi-infinite region which is homogeneous and isotropic and has free-space permeability and arbitrary permittivity and conductivity. The electric field in the slot is assumed to have the form of the TEM parallel-plate transmission line mode. The admittance per unit length of the slot is then calculated from the complex power flowing through the slot. The admittance is found as a function of the slot dimension, the frequency, and the constitutive parameters of the lossy region. J.E.T.

N64-13210 Sperry Gyroscope Co., Great Neck, N.Y.
EXPERIMENTAL EVALUATION OF COMPATIBLE PWI/CAS INTERROGATOR-TRANSPONDER TECHNIQUES, VOLUME 2 OF 2 Interim Report
Sep. 1963 119 p
(Contract FAA/ARDS-444)
(EB-5261-0341-2)

Descriptions of the components which make up the interrogators and the transponder equipment (coders, decoders, and computers) are presented along with some suggested circuit

modifications. Also a list of special test equipment needed for operation of the breadboard equipment is included, as well as instructions for alignment of the breadboard and test equipment. P.V.E.

N64-13243 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics

A MULTICHANNEL ELECTROENCEPHALOGRAPHIC TELEMETERING SYSTEM

Frederick Terry Hambrecht 6 Nov. 1963 35 p refs

(Contract DA-36-039-SC-78108; Grant DA-SIG-36-039-61-G14; NSF Grant 16526; NIH Grant MH-04737-03)

(RLE TR-413; AD-424621)

A four-channel electroencephalographic telemetering system, small enough to be carried by an animal of the size of a cat, has been designed and built. Descriptions of the differential amplifiers, pulse-duration multiplexing circuitry, transmitter and receiver, and decoding circuitry are given here. Details for reproduction of the system, and a simple module method for adding more channels are described. Each channel of the four-channel system has a frequency range 0.7 to 2000 cps with a noise level referred to the input of 5 μv peak-to-peak at 10,000 ohms. The overall operating range of the system is 200 ft. Author

N64-13261 Illinois U., Urbana Electrical Engineering Research Lab.

RESEARCH STUDIES ON PROBLEMS RELATED TO ANTENNAS Quarterly Report No. 4, 1 Jun.-31 Aug. 1963

G. A. Deschamps and Paul E. Mayes Oct. 1963 43 p ref

(Contract AF 33(657)-10474)

(AD-424471)

Research activities in the following areas are discussed: (1) investigation to explain the observed properties of log-periodic (LP) antennas through experimental and analytical investigation of their uniform periodic counterparts; (2) development of an LP array of cavity-backed slots which will produce vertically polarized radiation without having the structure projecting above the ground plane; (3) investigation of an LP array of magnetic dipole elements; (4) study of the characteristics of present forms and new versions of the conical logarithmic spiral antenna; (5) investigation of the feasibility of utilizing varactor diodes in a backfire antenna to produce amplification in the antenna itself and thereby improve signal-to-noise performance; (6) study of periodic structures for wideband applications; (7) determination of the feasibility of developing a high-resolution millimeter antenna by coupling from a Goubau beam waveguide to a radiating lens; (8) investigation into the operation of zone phase plates; and (9) investigation of the diffraction properties of uniform and modulated grating-type structures. P.V.E.

N64-13279* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

SYSTEMATIC STATISTICS USED FOR DATA COMPRESSION IN SPACE TELEMETRY

Isidore Eisenberger and Edward C. Posner 1 Oct. 1963 48 p refs

(NASA Contract NAS7-100)

(NASA CR-53031; JPL-TR-32-510) OTS: $4.60 ph, $1.64 mf

The need for data compression, a consequence of the demands made on the telemetry system of a space vehicle, prompts consideration of the use of sample quantiles in estimating population parameters and obtaining tests of goodness of fit for large samples. In this paper optimal unbiased estimators of the mean and standard deviation are given using up to twenty quantiles when the population is normal. Moreover, the estimators are relatively insensitive to deviations from normality. A distribution-free goodness-of-fit test is presented based on the sum of the squares of four quantiles after an orthogonal transformation to independent normal deviates. If a frequency function is of the form $f(x;p) = pf_1(x) + (1 - p)f_2(x)$, $0 < p < 1$, where f_1 and f_2 are normal frequency functions, the distribution is likely to be bimodal. Author

N64-13335* Alabama U., Research Inst., Huntsville

COMMUNICATION BLACKOUT AT RE-ENTRY

F. J. Tischer Sep. 1963 15 p refs Presented at the Fifth Intern. Symp. on Space Technol. and Sci. (ISTS), Tokyo, 2–7 Sep. 1963

(NASA Grant NsG-381)

(NASA CR-55167; UARI-RR-61) OTS: $1.60 ph, $0.80 mf

Procedures are outlined for computing the approximate attenuation of radio signals transmitted through the shock layer of a large reentry vehicle and the communication blackout time. A review of the computation methods and of the availability of the data needed in these computations indicates that approximate methods with simplifications applied in most of the phases of the computation represent, at present, one of the most fruitful approaches for obtaining estimates for the communications blackout at reentry. Based on this concept, approximate equations are derived for the reentry attenuation. The derived equations are then applied to the reentry of a manned space capsule (MA-6 Mercury flight) into the earth's atmosphere. Author

N64-13394* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

OPTIMAL SEARCH PROCEDURES

Edward C. Posner 1 Jul. 1963 5 p refs Repr. from IEE Trans. Profess. Group Inform. Theory, v. IT-9, no. 3, Jul. 1963

(NASA Contract NAS7-100)

(NASA CR-53040; JPL-TR-32-475)

This paper sets up a restricted class of search procedures for a satellite lost in a region of the sky. The satellite must be found by a radar search. The procedures under consideration allow the use of a preliminary search, which may be done with a wider beam than is required for the final search. The purpose of the preliminary search is to obtain a ranking of the various portions of the sky, so that the final search can examine the more likely regions of the sky first. It is shown that a preliminary search can reduce the expected search time, no matter how wide a beam is used. It is also shown that the preliminary search with the narrowest possible beam is best. Author

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-12458 Joint Publications Research Service, Washington, D.C.

THE THEORY OF PULSE COINCIDENCE OF DEPENDENT CURRENTS

N. M. Sedyakin *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 120–132 refs (See N64-12451 04-01) OTS: $5.00

The analysis of a wide circle of scientific-technological problems is reduced with regard to their mathematical parts to the problem of pulse coincidence for a series of currents. Previous investigators have carried out their studies under the assumption of fixed independent current. In the present work, the requirement that the currents be independent is dropped and consequently the solution to the problems of coincidence which are obtained here has a highly general character. As a result of the investigations carried out, new regularities have been established which characterize the process of pulse coincidence for a given number of fixed dependent currents; also certain principles are made more accurate. Author

N64-12462 Joint Publications Research Service, Washington, D.C.

THE INFLUENCE OF NOISE ON STEP-TYPE EXTREMAL SYSTEMS WITH SEQUENTIAL ANALYZERS

V. M. Mokhov and V. P. Tarasenko *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 162–178 refs (See N64-12451 04-01) OTS: $5.00

Two step-type extremal systems are described in which decisions are made concerning the direction of search steps; the decisions are made using the sequential analysis method of Wald. Both transient and fixed conditions for operation of this system are investigated with random noise at the input and output points of the control unit. Author

N64-12558* Oak Ridge National Lab., Tenn.

PERFORMANCE CHARACTERISTICS OF MODULAR NANOSECOND CIRCUITRY EMPLOYING TUNNEL DIODES

N. W. Hill, R. J. Scroggs, and J. M. Madison *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 127–140 refs (See N64-12531 04-01) OTS: $2.75

Modular circuits employing tunnel diodes have been used in the instrumentation for many of the high-energy particle experiments described. These circuits include discriminator modules, coincidence and anticoincidence modules, positive and negative output scaler-driver modules used to drive commercially built scalers, and a 100-Mc scaler-driver module. Their response to various conditions of temperature and input pulse magnitude was measured. Author

N64-12597 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

EYE MELANIN FREE RADICAL KINETICS AND MECHANISM IN RELATION TO THE ROGINSKY-ZELDOVICH (OR ELOVICH) EQUATION AND THE ABSORPTION OF OXYGEN BY SEMICONDUCTORS

Freeman W. Cope 30 Sep. 1963 21 p refs
(NADC-MA-6320; Rept. No. 23; AD-423767)

Eye melanin-free-radical decay was previously shown to conform to an equation derived from a postulate that the rate-limiting step was electron conduction across the liquid-solid interface at the surface of the melanin particle. It is shown here that this equation closely approximates the Roginsky–Zeldovich (or Elovich) equation for oxygen adsorption on inorganic semiconductor solids, which provides two convenient graphical criteria for this type of kinetics. Because the behavior of charge carriers is essentially similar in liquids and solids, it is believed that this derivation of the Roginsky–Zeldovich equation is also applicable to phenomena at solid-solid interfaces in inorganic semiconductors. Author

N64-12600 Aerospace Corp., El Segundo, Calif. Engineering Div.

EFFECTS OF VARIOUS RE-ENTRY VEHICLE PARAMETERS ON RF ATTENUATION

F. A. Vicente 28 Oct. 1963 64 p refs
(Contract AF 04(695)-269)
(BSD-TDR-63-227; TDR-269(4810-30)-1; AD-297942)

The effects of antenna location, cone-angle nose radius, signal frequency, velocity, and wall temperature on RF signal attenuation are examined. Results for the various parameters are presented, as well as altitude-velocity maps for lines of constant RF attenuation. A clean, equilibrium air-fluid-flow model is assumed, and the results presented for a thin slab electromagnetic model and for a semi-infinite electromagnetic model. Author

N64-12607 Aerospace Corp., El Segundo, Calif.

BANDWIDTHS FOR PROGRAM 369

F. F. Yates 20 Nov. 1963 14 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-206; TDR-269(4111)-4; AD-423651)

In establishing the gross system design and estimating performance for Program 369, it is desirable to consider the relationship between baseband bandwidths and output signal-to-noise ratio, and the effect of satellite repeater bandwidths. Develet and others have derived direct relationships between the system output signal-to-noise ratio and the input signal-to-noise ratio in a baseband bandwidth. These expressions are used to compute the maximum bandwidth for each of the two cases mentioned above. Author

N64-12608 Texas U., Austin Electrical Engineering Res. Lab.

BOUNDARY-LAYER-WIND MAXIMA AND ASSOCIATED TEMPERATURE DISTRIBUTIONS AS OBSERVED ON THE 1400-FOOT TELEVISION TOWER NEAR DALLAS, TEXAS 1961-1962 Scientific Report No. 1

K. H. Jehn and S. J. Durie Bedford, Mass., Air Force Cambridge Res. Labs., 1 Oct. 1963 32 p refs
(Contract AF 19(604)-2459)
(Rept 4-09; AFCRL-63-738; AD-423523)

Significant wind maxima (one occurrence of a 10-minute average wind maximum per day—2000 CST to noon of the following day) were tabulated, along with time and height of occurrence and windspeed. Wind maxima were most frequent in July (>80%) and at a minimum in the winter months (~40%). Wind profiles were related to temperature structure by cataloging the temperature profiles, and comparing wind profiles on the basis of temperature profile category. More cases of wind maximum were associated with a ground-based inversion surmounted by a lapse layer than any other temperature category. Author

N64-12610 Northeastern U., Boston, Mass.

MAXIMUM-LIKELIHOOD DETECTION IN A BINARY CHANNEL WITH MEMORY Scientific Report No. 4

Robert A. Gonsalves and Walter H. Lob Jul. 1963 42 p refs
(Contract AF 19(604)-7494 and Grant AF-AFOSR-62-371)
(AFCRL-63-313; AD-425602)

The form of the maximum-likelihood detector for binary signals transmitted sequentially over a channel with memory is examined. The channel memory is assumed short enough so that there is intersymbol interference between adjacent symbols only. The mathematical specifications and a block diagram for such detectors are described for the cases where a decision on μ_k, the k'th binary signal, is made: (1) after y_k, the received

waveform during the k'th observation interval corresponding to μ_k, has been received, (2) after γ_{k+1} has been received, (3) after all data have been received. In all cases implementation is achieved with adders, unit delays, two matched filters, and nonlinear amplifiers. With the aid of a simplifying assumption, upper and lower bounds of the per symbol error probability are derived. These bounds check reasonably well with the results of a digital "Monte Carlo" experiment. Author

N64-12642 Harry Diamond Labs., Washington, D.C.
DESIGN PROCEDURE FOR A TRANSISTOR RING COUNTER
Ira R. Marcus 15 Oct. 1963 21 p
(TR-1154; AD-423742)

A design procedure for the transistor ring counter is derived. Using this procedure, a 30-μw decade ring counter and a 500-kc decade ring counter were built. Both operated satisfactorily. Author

N64-12646 Philco Corp., Blue Bell, Pa.
THE PRENORMALIZATION OF RECONNAISSANCE DATA Final Report
John. F. Bogusz H. G. Kellett, and J. S. Bryan 25 Jul. 1963 208 p
(Contract AF 30(602)-2793)
(Philco VO44-F; RADC-TDR-63-372; AD-422946)

This report describes and evaluates several techniques for the prenormalization of gray-scale aerial photographs prior to their use as input to an adaptive memory recognition system. It summarizes the evidence for analogous preprocessing operations in the animal visual system. The report discusses the implementation and testing of several preprocessing techniques which reduce the gray-scale input data to binary form. The utility of candidate techniques in connection with automatic detection of targets on aerial photographs is estimated by comparing recognition error rates on a computer-simulated adaptive memory recognition system. Problems associated with high-speed prenormalizing techniques were investigated through the construction of a real-time gradient mapping system, which also permits evaluation of certain parameter variations on various types of target images. The report describes a preferred implementation for a versatile prenormalization device, suitable for use in various recognition tasks. Author

N64-12666 Army Missile Command, Huntsville, Ala. Plasma Physics Branch
THEORY FOR PLASMA FILLED DIODES
Charles Cason 15 Oct. 1963 14 p refs
(RR-TR-63-22; AD-423086)

A theoretical analysis of thermoelectric properties of thermionic converters is made according to a Langmuir probe analogy beginning with Kirchhoff's current law. An expression is developed for the load voltage in terms of external circuit current, thermionic electrode characteristics, and plasma properties. Very good agreement between predicted diode properties and observations is shown at low pressure. Author

N64-12676 Sylvania Electric Products, Inc., Mountain View, Calif. Microwave Device Div.
DESIGN AND DEVELOPMENT OF A PHOTOMIXING DEVICE Final Report
D. E. Caddes 9 Aug. 1963 76 p refs
(Contract AF 19(628)-1671)
(AFCRL-63-379; AD-422961)

A traveling-wave phototube (TWP) has been developed which is capable of photomixing optical signals of differing frequency content and detecting the resultant difference frequency signal (beat) over the 11 to 20 Gc band. This represents the broadest bandwidth presently available in a practical photodetector. An important spectroscopic application of this tube would be in the examination of laser outputs. In addition to its photomixing capability, this TWP is a sensitive detector of amplitude modulation of light over this same broad bandwidth. Author

N64-12679 Brown U., Providence, R.I.
A MICROWAVE INVESTIGATION OF SELF-QUENCHING CYLINDRICAL DISCHARGES AT LOW PRESSURES Scientific Report 3
Paul R. Caron and Ralph D. Kodis Bedford, Mass., AF Cambridge Research Labs., Jun. 1963 69 p refs
(Contract AF 19(628)-2498)
(AFCRL-63-343; AF 2498/3; AD-422954)

This report presents the results of a theoretical and experimental investigation of self-quenching cylindrical discharges at low pressures in nitrogen and oxygen. The quenching theory is based on the electric field dependence of the first Townsend coefficient and leads to an integro-differential equation of the Volterra type whose solution gives the time variation of the frequency shift of a microwave cavity housing the discharge. The measurements were carried out in a TE_{011} mode cavity, and the advantages of this mode are discussed. Experimental values of cavity frequency shift during the quenching period are obtained and are compared with theoretical results. Formulas are derived for the electron density and percentage ionization during the quenching period of the discharge. Author

N64-12681 RAND Corp., Santa Monica, Calif.
ANOMALOUS SOUNDS AND ELECTROMAGNETIC EFFECTS ASSOCIATED WITH FIREBALL ENTRY
Mary F. Romig and Donald L. Lamar Jul. 1963 66 p refs
(Contract ARPA-SD-79; ARPA Order 189-61)
(RM-3724-ARPA; AD-412816)

Observers located as much as 300 km from the ground trace of bright fireballs have reported hearing swishing sounds simultaneously with the fireball passage. These sounds are anomalous because the geometry of fireball path and observer locations requires that the effect producing the sound sensation be propagated at the speed of light. Sound-producing fireballs are extinguished at lower altitudes and are brighter than ordinary meteors. These fireballs deposit kinetic energy at altitudes below 30 km at rates on the order of at least 10^{16} ergs/sec. The description of the anomalous sounds as a hissing or crackling and rare reports of odors which may be ozone suggest that the sound is associated with electric discharges. The most plausible explanation of the anomalous sounds is that they are caused by electric discharges near the observer. These discharges may be the result of perturbation of the geopotential gradient by the fireball. It is also possible that the anomalous sounds are due to strong electromagnetic radiations from the fireball which are transduced by natural objects, perhaps even the human ear. Author

N64-12710 Harry Diamond Labs., Washington, D.C.
HIGH-FREQUENCY, DIFFUSED-BASE, GERMANIUM TRANSISTORS WITH VACUUM-DEPOSITED LEADS
R. J. Anstead, G. B. Wetzel, O. L. Meyer, and M. L. Jones 15 Nov. 1963 32 p refs
(TR-1100; AD-424955)

The feasibility of using vacuum-deposited aluminum leads to the base and emitter electrodes of high-frequency mesa-type diffused-base germanium p-n-p transistors was investigated. The aluminum was evaporated onto transistors with

electrodes of two sizes: 2 by 6 mil and 4 by 12 mil. The yield and the overall performance of transistors with vacuum-deposited leads were poorer than with comparable transistors having thermal-compression bonded leads. The low yield with deposited leads was due to short circuits between the leads and the transistor die. Yields in the deposited-lead fabrication step alone ran as low as 10 percent. The transistors were made using photoengraving techniques entirely. The design considerations and fabrication processes are described in detail. Author

N64-12727 Joint Publications Research Service, Washington, D.C.
SIMILARITY OF VACUUM ELECTRONIC SYSTEMS
N. S. Neyman *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 1–27 refs (See N64-12726 04-01) OTS: $4.00

A system of relations is presented, which is derived from the similarity conditions of vacuum electronic systems with geometrical similarity, and with the longitudinal direction singled out. The following cases are considered: (1) type O devices, (2) type M devices, (3) devices with small electron range angles. The application of the similarity conditions for the simulation of high-power electronic devices is discussed, as well as the use of the similarity conditions for an estimate of the influence of the parameters, wavelength, power, voltage, cathode emissivity, permissible specific dissipation power, etc. Author

N64-12729 Joint Publications Research Service, Washington, D.C.
ANALYSIS OF OPERATION OF CAPACITIVE PARAMETRON
G. I. Rassokhin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 48–74 refs (See N64-12726 04-01) OTS: $4.00

One type of capacitive parametrons is considered which is widely used in computational technology and which makes it possible to operate at very high frequencies. A differential equation is derived to describe the operation of the capacitive parametron, and a theoretical analysis is made of the operation of this parametron using the approximation of the nonlinear parameter by means of a third-degree polynomial. Account is taken of the influence exerted on the characteristics of the parametron by the forward conductivity of the diode, which determines the damping of the parametric resonant circuit. Author

N64-12730 Joint Publications Research Service, Washington, D.C.
DESIGN AND CALCULATION OF INDUCTIVE PARAMETRONS
V. A. Sokolov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 75–97 refs (See N64-12726 04-01) OTS: $4.00

The main theoretical premises underlying the technical design of inductive parametrons using ferrite cores are considered. Calculation formulas and experimental results concerning the calculations are given. Author

N64-12731 Joint Publications Research Service, Washington, D.C.
RECIPROCAL FERRITE SWITCH BASED ON A SLOT BRIDGE
V. S. Averbakh and Yu. M. Zhidko *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 98–113 refs (See N64-12726 04-01) OTS: $4.00

An analysis is presented of the operation of a ferrite switch, consisting of a power divider, two ferrite phase shifters, and a slot bridge. The influence of the errors in the individual units of the switch on its operation as a whole is estimated. Results are presented of an experimental investigation of a ferrite switch, designed to operate over a wide frequency range. Author

N64-12732 Joint Publications Research Service, Washington, D.C.
MODEL OF DIFFUSION TRANSISTOR
V. V. Galitskiy *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 114–127 refs (See N64-12726 04-01) OTS: $4.00

A model is considered for a diffusion transistor connected in a grounded-base circuit. A calculation is presented for a uniform RC line, representing the base region, and considerations are advanced concerning the choice of the scale coefficients. Author

N64-12733 Joint Publications Research Service, Washington, D.C.
METHOD OF SYNTHESIS OF FREQUENCY AND TRANSFER CHARACTERISTICS OF A TWO-PORT NETWORK
Yu. G. Kuleshov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 128–143 refs (See N64-12726 04-01) OTS: $4.00

The function of the amplitude-phase-frequency characteristic is represented as the sum of cosinusoidal and sinusoidal components, treated as transforms of the corresponding linear combinations of Dirac impulse Δ functions. The similarity and differences of such a representation with respect to the existing methods are noted. It is possible to construct a circuit with frequency properties controllable in amplitude and in phase, based on simulation of the functions—originals with the aid of transients in open- and short-circuited lines. The problem of construction of the transfer characteristic from the frequency characteristic is touched upon. Author

N64-12734 Joint Publications Research Service, Washington, D.C.
MUTUAL SYNCHRONIZATION OF SELF-OSCILLATING, WITH A MULTIPLE RATIO OF OSCILLATION, FREQUENCIES
V. P. Rubanik *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 144–154 refs (See N64-12726 04-01) OTS: $4.00

It is shown with the aid of an approximate asymptotic method that mutual synchronization exists between coupled self-oscillators with natural frequencies that are in approximate multiple ratio. The influence of the delay in the coupling forces on the processes of mutual synchronization in a case of a multiple frequency ratio is investigated. Author

N64-12735 Joint Publications Research Service, Washington, D.C.
METHOD OF MEASURING THE NEGATIVE RESISTANCE OF TUNNEL DIODES

I. I. Shagurin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 155–164 refs (See N64-12726 04-01) OTS: $4.00

A simple method is proposed for the measurement of the differential negative resistance of tunnel diodes, using a minimum of necessary apparatus. This method does not have the shortcomings which are common to the bridge method and the voltage divider method. The measurement procedure, measurement error, and the measurement results using the proposed method are given. The results of the measurements show that the given method can be used for an exact measurement of the negative resistance of tunnel diodes in the voltage range $U_1 \leq U \leq U_2$. The measurement procedure is simple and calls for a minimum amount of apparatus. The oscillations occurring in the circuit have an amplitude of the order of 10 mv and more. Therefore, in order to fix them, the indicator required is of relatively low sensitivity. C.L.W.

N64-12736 Joint Publications Research Service, Washington, D.C.

CHOICE OF OPTIMAL CONSUMPTION OF ELECTRIC POWER IN ELEMENTS OF RADIO APPARATUS

N. F. Vollerner *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 165–176 refs (See N64-12726 04-01) OTS: $4.00

It is shown that the optimum efficiency (consumption of electric power) of elements of radio apparatus, for a minimum total weight or course, is determined by the power supplies and by the length of operation. Author

N64-12737 Joint Publications Research Service, Washington, D.C.

ELECTRONIC FILTER WITH PARALLEL TUBE

Ya. I. Tetel'baum *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 177–201 refs (See N64-12726 04-01) OTS: $4.00

An electronic filter using a parallel tube was fed from a rectifier with a Pi-type smoothing filter at an output capacitance C = 20 microfarads with a ballast resistor R = 4 kilo-ohms. Graphs are included which show the dependence of the coefficient of filtration on the following quantities: (1) grid bias, (2) capacitance of the coupling capacitor, (3) load resistor, (4) automatic bias resistor, and (5) the value of the supply line voltage. R.T.K.

N64-12738 Joint Publications Research Service, Washington, D.C.

FREQUENCY CHARACTERISTICS OF A SYSTEM OF TWO COUPLED CIRCUITS WITH VARIABLE CAPACITANCE IN ONE OF THE CIRCUITS

L. A. Smirnova and N. V. Soina *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 202–206 refs (See N64-12726 04-01) OTS: $4.00

The results are presented of the calculation of the characteristics of a system of two coupled circuits with variable capacitance in one of the circuits, when the circuits have different natural frequencies and the losses in the circuits are not equal. The system of Kirchoff equations that describes the system under consideration is given. R.T.K.

N64-12739 Joint Publications Research Service, Washington, D.C.

DYNAMIC CHARACTERISTICS OF A CIRCUIT WITH VARIABLE CAPACITANCE AT LOW REGENERATION LEVEL

Ye. M. Gershenzon, T. F. Lyubimova, G. I. Rozhkova, and V. S. Etkin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 207–211 refs (See N64-12726 04-01) OTS: $4.00

On the basis of the formulas for the mean square of the amplitude, and for the squares of the amplitudes of the components at the signal frequency and at the difference frequency, it was possible to obtain the characteristics of a system with variable capacitance at low regeneration level. The characteristics of the system calculated from the exact and asymptotic formulas are presented in the form of curves. R.T.K.

N64-12740 Joint Publications Research Service, Washington, D.C.

ON THE THEORY OF APPROXIMATION OF TWO CHARACTERISTICS AT LARGE VOLTAGE AMPLITUDES

M. I. Khodzishskiy *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 212–223 refs (See N64-12726 04-01) OTS: $4.00

The approximation of vacuum tube characteristics was investigated by means of the difference of two exponential functions. A description is given of the static and dynamic anode-grid characteristics of the tube in the case of large voltages on the grid. R.T.K.

N64-12741 Joint Publications Research Service, Washington, D.C.

AUTOMATIC OPTIMIZATION OF CHARACTERISTICS OF A FERRITE SWITCH

V. V. Koshelev and V. I. Talanov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 224–233 refs (See N64-12726 04-01) OTS: $4.00

A model of an automatic tuning system is described. The system was investigated in order to ascertain the possibility of automatic optimization of the characteristics of the ferrite switch by variation of the ferrite parameters. Automatic tuning of the ferrite switch was obtained by variations in the signal frequency although the circuit could not be used with excessively low levels of a high frequency signal. R.T.K.

N64-12743 Joint Publications Research Service, Washington, D.C.

CONVERSION OF FREQUENCY MODULATED OSCILLATIONS INTO AMPLITUDE-FREQUENCY-MODULATED OSCILLATIONS BY A DIFFERENTIATING DEVICE

L. Ya. Il'nitskiy *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 241–246 refs (See N64-12726 04-01) OTS: $4.00

The FM oscillations were converted by a differentiating device into an AFM (amplitude-frequency-modulation) oscillation. The AFM oscillation obtained in this manner can be demodulated with an ordinary amplitude detector. R.T.K.

N64-12745 Joint Publications Research Service, Washington, D.C.

ON THE OPTIMALITY OF STEP-TYPE CHEBYSHEV TRANSFORMERS

G. P. Veselkov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ., USSR, Radio Eng. Ser. 4 Dec. 1963 p 252–259 refs (See N64-12726 04-01) OTS: $4.00

Chebyshev step-like transformers with quarter-wave lengths of steps were found to be optimal with respect to the variation of their geometrical dimensions. This conclusion was found to be valid for all other step-like junctions. R.T.K.

N64-12814 Massachusetts Inst. of Tech., Cambridge, Mass.
DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS
W. B. Westphal Oct. 1963 89 p refs
(Contract AF 33(616)-8353)
(MIT-TR-182; AD-423686)

Measurement techniques for the frequency range 10^2 to about 2.5×10^{10} are discussed for temperatures to 1650° C. These include the use of bridges, resonant circuits, standing-wave methods, and resonant cavities. Data on crystals of Al_2O_3, Cr_2O_3, MgO, $LaAlO_3$, Y_2O_3; on multicrystalline bodies of Al_2O_3, BeO, MgO, Mg_2SiO_4, Ta_2O_5, ThO; on glass ceramics, silica glass, and BN are presented over smaller temperature and frequency ranges. Pyrolitic BN has a low loss tangent (0.0004 at 1375° C, 4.8×10^9 cps) and a low-temperature coefficient of dielectric constant. Some aluminas and silicas exhibit loss tangents of about 0.0006 at 1000° C in the microwave region. Microwave losses are due partly to the charge transfer responsible for low-frequency conductivity and to the vibration spectra of infrared absorption. Both losses are increased by the addition of impurities. Author

N64-12826 Massachusetts Inst. of Tech., Cambridge
PROGRESS REPORT NO. XXXIII, LABORATORY FOR INSULATION RESEARCH
A. R. Von Hippel Jul. 1963 92 p
(Contracts Nonr-1841(10); Nonr-1841(88); AF 19(628)-395; AF 33(616)-8353; and AF 19(604)-8483)
(AD-422096)

This project was set up to provide fundamental information on the behavior of dielectrics as functions of temperature and field strength; on their degradation under load; on the production of thin films and the formation of definite interfaces in ultrahigh vacua; on electron transfer through such films; on the vapor phase above dielectrics as measured by the new quadrupole mass spectrograph; and on correlations between structure and properties. Various dielectric-measurement techniques are to be extended to ever higher temperatures, and the characteristics of interesting materials are to be investigated. Author

N64-12827 American Meteorological Society, Boston, Mass.
THE ELECTRIC MASS FILTER [DAS ELEKTRISCHE MASSENFILTER]
W. Paul and M. Raether Bedford, Mass. AF Cambridge Res. Labs., Aug. 1963 18 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 140, 1955 p 262–273
(Contract AF 19(604)-6113)
(T-G-124; AD-421983)

An entirely electrically operated mass filter for determining the specific charge of ions is examined. The acceleration of an ion (dependent on time) in a high-frequency electric field is measured and used for segregating the masses. The spatial distribution of the electric field is characterized by the need for its potential V(x, y, z, t) to be a purely quadratic function of the coordinates x, y, z. A specific case and experimental results are discussed. J.E.T.

N64-12914 European Organization for Nuclear Research, Geneva (Switzerland) Accelerator Research Div.
DISC-LOADED DEFLECTING WAVEGUIDE
H. G. Hereward and M. Bell 15 Oct. 1963 69 p refs
(CERN 63-33)

The theoretical basis of a program for computing the properties of a discloaded circular waveguide structure used to carry a deflecting radiofrequency field is presented. R.T.K.

N64-12926 General Dynamics/Fort Worth, Tex.
STUDIES OF MAGNETIC SHIELDING AND SUPERCONDUCTIVITY
J. M. Norwood and F. L. Gibbons 4 Nov. 1963 48 p refs
(Contract AF 33(657)-11214)
(ERR-FW-210; AD-423178)

Theoretical considerations of magnetic (active) shielding of space vehicles against charged-particle cosmic radiation indicate inadequate treatment in feasibility studies. Simplified expressions for the magnetic vector potential lead to predictions of possibly fictitious completely shielded regions. The mathematical model presented avoids this deficiency, and a method of determining the completely shielded regions is developed. Experimental investigations establish the capability of winding superconducting solenoids and making junctions between superconducting wire and current-carrying leads. Junctions made by spot welding superconducting Nb-Zr wire to copper electrodes, including foil, prove to be superior in reliability, simplicity, and high-current capacity. Critical currents in three superconducting solenoids, constructed to operate at 10, 15, and 22 kilogauss, were lower than those measured in short segments by amounts consistent with data in available literature. Author

N64-12930 Lincoln Lab., Mass. Inst. of Tech., Lexington
COMPUTATION OF THE SPREADING OF AN ELECTRON BEAM UNDER ACCELERATION AND SPACE-CHARGE REPULSION
G. E. Vibrans 18 Apr. 1963 25 p refs
(LL-TR-308; AD-409705)

The known differential equation, which describes the spreading of a circular electron beam in an accelerating field under space-charge repulsion, is derived in a simplified form so that the general solution can be precomputed. The solution is discussed and is given in a diagram. All auxiliary calculations are listed in order that the beam radius can be found for any set of initial conditions. Only the diagrams and a slide rule are needed. Another independent method of computation for the same purpose, which may be useful under special conditions, is also included. Author

N64-12933 Harry Diamond Labs., Washington, D.C.
A TWO-WIRE SETTING SYSTEM FOR ELECTRONIC TIMERS
Ira R. Marcus 30 Sep. 1963 17 p
(HDL-TR-1150; AD-422710)

A method for setting an electronic timer through two wires is described. The electronic timer is powered, reset, set, monitored, and its safety status line checked through two wires connecting the setter and the timer. Author

N64-12980 Dow Chemical Co., Midland, Mich. Dow Metal Products Co.
INVESTIGATION OF THE MAGNESIUM ANODE Fourth Quarterly and Final Report, 1 Apr.–31 Jul. 1963
J. L. Robinson [1963] 139 p refs
(Contract DA-36-039-SC-89082)

Investigations of magnesium anodic behaviors with $Mg(ClO_4)_2$, $MgCl_2$, and $Mg(Ac)_2$ electrolytes were carried out.

Some of the more pertinent observations were: cessation of the wasteful corrosion reaction with increasing anode potential (passive direction) with $MgCl_2$ and $Mg(ClO_4)_2$ electrolytes; the persistence of higher closed circuit corrosion rate upon removal of an applied current with $MgCl_2$ electrolyte; an increase in the corrosion rate with removal of applied current with $Mg(Ac)_2$ and $Mg(ClO_4)_2$ electrolytes; the dependency of the anodic potential transient ("delayed action") on the magnitudes of applied and corrosion currents; and the excellent correspondence between anodic transients measured in half cells and dry cells and marked effect of chromate ion on their magnitude. Data on the effects of electrolyte concentration, anode composition, and temperature on the behavior were obtained.

Author

N64-12983 General Motors Corp., Kokomo, Ind.
PRODUCTION ENGINEERING MEASURE TO IMPROVE PRODUCTION TECHNIQUES AND INCREASE THE RELIABILITY OF THE 2N1358A TRANSISTOR Quarterly Progress Report No. 5, Apr. 30, 1963-Jul. 30, 1963
J. C. Kuhns [1963] 72 p
(Contract DA-36-039-SC-86725)
(AD-423248)

The development of the programs to revise the alloy regrowth process to minimize spur regrowth, and assembly revisions to minimize wisp formations, are being complicated by interactions from some of the other processes being introduced. These changes, most notably the hot hydrogen mounting and the precap baking, are influencing some of the parameters and require adjustments in the manufacturing operations to provide optimum yields of premium-type devices. Failure rates and graphs of parameter distributions of Milestone III tests are included in this report. Preliminary information from Milestone IV transistors is reported.

Author

N64-12989 Fairchild Semiconductor Corp., Mountain View, Calif.
PRODUCTION ENGINEERING MEASURE 2N914 AND 2N995 Quarterly report, 1 May 1960-31 Jul. 1963
P. M. Weiler [1963] 60 p refs
(Contract DA-36-039-SC-86726)
(AD-422641)

Progress is reported in the areas of lead-attach improvement, preparation of substrate for epitaxial growth, improved header plating, and the elimination of gross particles during the final sealing operation.

J.E.T.

N64-12990 Carnegie Inst. of Tech., Pittsburgh, Pa.
THE ELECTRIC FIELD GRADIENT TENSOR IN FERROUS COMPOUNDS Technical Report No. 3
R. Ingalls 22 Jul. 1963 36 p refs
(Contract Nonr 760(20))
(AD-425685)

The electric field gradient tensor at the iron nucleus in ferrous (Fe^{2+}) compounds is investigated. Under the combined action of axial and rhombic crystalline fields and the spin-orbit interaction, the ferrous ion (^5D, $3d^6$) d_ϵ states produce a large temperature-dependent contribution to the electric field gradient tensor. It is found that this direct contribution is diminished by that of the lattice itself (the second-order axial and rhombic components of the crystalline field), as well as by Sternheimer polarization effects and covalency. The results of this investigation are then applied to Mossbauer results in $FeSiF_6.6H_2O$ to obtain an estimate of the electric quadrupole moment of Fe^{57m} ($0.29 \pm 0.02b$), which is in agreement with that of the ferric (Fe^{3+}) studies.

Author

N64-12998 Motorola, Inc., Phoenix, Ariz.
PRODUCTION DEVELOPMENT OF A SILICON PLANAR EPITAXIAL TRANSISTOR WITH A MAXIMUM OPERATING FAILURE RATE OF 0.001% PER 1000 HOURS AT A CONFIDENCE LEVEL OF 90% AT 25°C Fourth Quarterly Report, 1 Feb.-30 Apr. 1963
Wilfred Corrigan et al [1963] 24 p
(Contract DA-36-039-SC86728)
(AD-422536)

Each of the processes to be improved are discussed. An important advancement is reported in the epitaxial starting material process—the cause and elimination of "phantom p" layers. Reliability engineering work covered the acceleration factor experiment and the all-aluminum system devices.

Author

N64-13031 General Electric Co., Syracuse, N.Y.
RESEARCH ON THIN FILM INSULATORS Second Interim Engineering Report
J. M. Blank, A. E. Cahill, S. W. Ing, V. A. Russell and W. J. van der Grinten Wright-Patterson AFB, Ohio, Aeron. Systems Div., 25 Oct. 1963 49 p refs
(Contract AF 33(657)-11079)
(AD-424628)

The purpose of this study is to investigate the conduction mechanisms in very thin insulating films with emphasis on producing tunnel electrons at room temperature. An investigation of electron emission into vacuum from metal-insulator-metal thin film sandwiches was initiated. Emission was observed from Al-SiO_2-Au and Al-SiO_2-Al structures 45 to 85 A thick. The highest emission current was 2μa from a 5-mm^2 area. When voltage is applied, these sandwiches experience an activation process which ultimately increases the conductivity of the insulation film by many orders of magnitude. Activation appears to increase the emission current. A continuous decrease in sample capacitance with increasing activation suggests that activation is more intense in localized areas of the insulation film.

Author

N64-13038 Radio Corp. of America, Somerville, N.J.
PRODUCTION ENGINEERING MEASURE ON 2N1708 SILICON PLANAR EPITAXIAL TRANSISTOR Quarterly Report No. 5, 1 May-30 Jul. 1963
F. Tumbelty [1963] 57 p refs
(Contract DA-36-039-SC-86729)

The failure analysis procedure is described; the results of failure analysis on both high temperature storage and operating life are given. An acceleration curve for high temperature storage life tests has been established. The results of mechanical and environmental tests are presented. A study of variables data before and after testing is included.

Author

N64-13039 Illinois U., Urbana Antenna Lab.
ON CONTINUOUSLY SCALED AND LOG-PERIODIC STRUCTURES
R. Mittra and K. E. Jones Sept. 1963 69 p refs
(Contract AF 33(657)-10474)
(Tech. Rept. 73; AD-422465)

Continuously scaled (CS) and log-periodic (LP) structures are treated on the basis of generalized Floquet's theorem and scaling principles, and the CS structure for a simple model of a loaded transmission line is related to its LP counterpart. Periodic structure approach, scaling principles and relation of periodic structures to continuously scaled and LP devices, CS and LP loaded transmission lines, and lumped LP approximation of the CS line are examined.

J.E.T.

N64-13050 European Organization for Nuclear Research, Geneva (Switzerland) Data Handling Div.
A MAGNETIC TAPE SYSTEM FOR THE CERN MERCURY COMPUTER
H. J. Slettenhaar 21 Aug. 1963 45 p refs
(CERN-63-32)

An Ampex TM-400 M magnetic tape unit has been connected to the CERN Mercury computer in such a way that reading and writing is in strict accordance with IBM magnetic tape specifications. A second magnetic tape unit is being added. This report describes the computer facilities used, the compatibility requirements, and the logical design of the control system. Author

N64-13065* Radio Corp. of America, Van Nuys, Calif. Data Systems Div.
PROTOTYPE MAGNETIC TAPE STATION Final Technical Summary Report, May 1962-Jun. 1963
1963 11 p
(NASA Contract NAS8-2636)
(NASA CR-52633) OTS: $1.60 ph, $0.80 mf

A summary is presented of the development and production of a prototype magnetic-tape station for the Saturn ground-computer system. P.V.E.

N64-13075 Lockheed Missiles and Space Co., Sunnyvale, Calif.
VACUUM DEPOSITION OF THIN FILM ELECTRONIC COMPONENTS: AN ANNOTATED BIBLIOGRAPHY
Scott J. Buginas, comp. Feb. 1963 39 p refs
(Contract NOw-63-0050)
(SB-63-15; AD-423673)

This bibliography contains references primarily within the span 1960 to 1962. A few key items from earlier years have been included to fill in subject gaps. Conductors, connectors, resistors, and capacitors were of prime interest. Author

N64-13076 General Motors Corp., Santa Barbara, Calif. GM Research Labs.
STUDY OF A THERMOPHOTOVOLTAIC CONVERTER First Quarterly Progress Report No. 1, 1 Jan.-30 Apr. 1963
Nov. 1963 66 p refs
(Contract DA-36-039-AMC-02255(E))
(TR63-228; AD-424010)

Theoretical and experimental studies were made to determine and improve the performance of potential components of a portable thermophotovoltaic converter for terrestrial applications, using conventional fuels. Both silicon and germanium cells were operated from hydrocarbon-powered heat sources and tested within inches of the 1400° C surface. Infrared transmission measurements were carried out with both n- and p-type materials over a range of doping levels. A 1400° C gray-body simulator was designed. The optical geometries of spherical and cylindrical configurations were considered. Ceramic structures approximating the shape of typical burner configurations were fabricated. Antioxidation coatings were studied, and one metallic alloy was tested at 1400° C. Seven different preheaters and six burner configurations were designed for purposes of comparison. Initial efficiency tests were performed on a modified thermionic-type heat source. Author

N64-13088 Joint Publications Research Service, Washington, D.C.
USE OF RECIRCULATORS FOR COMPRESSION OF FREQUENCY-MODULATED PULSES
V. V. Lebedev 13 Jan. 1964 14 p refs Transl. into ENGLISH of an article from Radiotekhnika (Moscow), v. 18, no. 11, Nov. 1963 p 62-70
(JPRS-22706; OTS-64-21270) OTS: $0.50

The following means of utilizing multiple circulators of an FM (frequency modulation) signal in a delay line with feedback, with the goal of isolating the signal noise, are considered: (1) passage of FM signals through a recirculator; (2) passage of an FM signal through a recirculator with mixing by a local oscillator; (3) frequency demodulation of the input signal; (4) compression of a frequency modulated pulse; (5) forming the required pulse characteristics of a filter; and (6) the isolation of an FM signal in noise by utilization of a recirculator. R.T.K.

N64-13113 Bell Telephone Labs., Inc., New York, N.Y.
AIRBORNE COMMUNICATION SYSTEM, MARCOM RELAY, PHASE I Quarterly Progress Report No. 5, 15 Jun.-15 Sep. 1963
15 Oct. 1963 89 p
(Contract DA-36-039-SC-89250)
(AD-424617)

This report describes the test plans for gathering data on air-to-air and ground-to-air microwave propagation and transmission; discusses procedures for handling raw data, for manual processing, and for processing magnetic tape; and includes information on the status of microwave and other equipment being procured. Author

N64-13116 Mitronics, Inc., Murray Hill, N.J.
CERAMIC MICROMINIATURE TRANSISTOR PACKAGE Final Report, 1 Jul. 1961-31 Mar. 1963
S. S. Cole, Jr. May 1963 107 p
(Contract DA-36-039-SC-87351)
(AD-403859)

On the basis of comparative properties, ease of sealing, and reliability, alumina was chosen as the most desirable ceramic material for the microminiature transistor package. Kovar (54% Fe, 28% Ni, 18% Co) was the most satisfactory metal. A package design was completed and approved for testing. Four hundred 2N697 transistors were wafer bonded into the packages, exact electrical testing parameters were determined; and life testing was carried out. R.T.K.

N64-13128 Hughes Aircraft Co., Culver City, Calif. Aerospace Group
STUDY OF ADVANCED ANTENNA TECHNIQUES FOR AEROSPACE VEHICLE DOPPLER VELOCITY SENSORS Quarterly Engineering Report No. 3
T. S. Fong et al Nov. 1963 20 p refs
(Contract AF 33(657)-10672)
(P-63-74; AD-422967)

The investigation is concerned with a flush-mounted antenna for an active Doppler velocity sensor for reentry-glide navigation on space vehicles. This antenna is required to generate four symmetrically oriented beams about its normal with 20 to 30 db of isolation (for pulsed operation) between the signals which are transmitted and received along each beam. In addition, the antenna beam direction must not be affected by variation in the attitude of the vehicle. A two-dimensional array of slots in square waveguide with four isolated feed ports was devised to meet this requirement. The array consists of a number of square waveguide branch lines which are fed by two square waveguide feed lines. Port isolation is obtained by utilizing the polarization isolation that exists between the TE_{10} and TE_{01} modes in the square waveguide. Author

N64-13130 IIT Research Inst., Chicago, Ill. Technology Center
EXCESS NOISE IN SEMICONDUCTORS Annual Summary Report No. 8, 15 Nov. 1962-14 Nov. 1963
James J. Brophy 4 Nov. 1963 47 p refs
(AD-423372)

The random spatial distribution of impurity atoms near a semiconductor p-n junction is examined experimentally by causing the space charge region of the junction to sweep through the distribution under a periodic reverse bias potential. The observed noise current spectrum is in reasonable agreement with the results of an analytical treatment based on a Poisson distribution except that some tendency for clustering of impurity atoms is suggested. Experiments to measure fluctuations in the optical absorption of germanium caused by random free carrier fluctuations associated with 1/f noise have shown that the effect is observable by increasing the strength of the transmitted infrared beam or by improving the detectivity of the infrared detector. The strength of the infrared beam is determined directly from noise measurements on the detector itself. Author

N64-13239 Utah U., Salt Lake City Microwave Devices Lab.
Consolidated Quarterly Report, 1 Apr.-30 Jun. 1963 [EXTENSION OF USEFUL FREQUENCY SPECTRUM AND IMPROVEMENT IN MICROWAVE SPECTRUM SYSTEMS]
30 Jun. 1963 98 p refs
(Contracts AF 04(647)-745; AF 33(657)-8677; and Nonr-1288(05); NSF Grant 15017)
(MDL-Q5; AD-424092)

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. Three areas examined are: (1) electron-beam studies, including backward-wave oscillators, dielectric slow-wave circuits, orbitron amplifiers, wave amplifiers, and multiple-beam interactions; (2) solid-state studies, including irradiated laser materials, tunneling studies, and millimeter wave masers; and (3) plasma studies, including plasma waves, generation, and measurement. J.E.T.

N64-13319 Williams (Clyde) and Co., Columbus, Ohio
QUANTITY-PRODUCED METALLIZED-TEFLON CAPACITORS – A STEP TOWARD SUCCESSFUL EXTREME SERVICE CIRCUITRY AN EVALUATION OF COMMERCIAL APPLICATIONS
C. R. Smith and W. H. Bickley [1963] 18 p refs
(Contract CC 4757)
(PB-181-537) OTS: $0.50

These capacitors, which exhibit self-healing characteristics, show great promise for extreme-service applications in the space and allied industries because of their ability to operate for as long as 1,000 hours at 140% of rated voltage—at 200° C. Furthermore, the volume of the capacitors (per microfarad of capacitance) has been reduced by a factor of four as compared with conventional foil-Teflon capacitors. Commercial winding equipment was successfully modified (magnetic tension control was incorporated) so that extremely thin films of Teflon can be wound under uniform tension without physical distortion. Author

N64-13397 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro
EVANESCENT-MODE EFFECTS IN THE DOUBLE-WEDGE PROBLEM
C. Marcio do Armaral and J. W. Bautista Vidal 1963 43 p refs
(*Its* Notas de Fisica, vol. 10, no. 11)

The diffraction of the principal mode at the open end of a semi-infinite parallel-plate waveguide terminated by an infinite plane flange (double-wedge) is studied in the interval $0.1 \leq ka \leq 1.7$, where k is the wave number and 2a is the guide width. The evanescent-mode correction to the reflection amplitude and the amplitudes of the evanescent modes are computed by three different approximation methods. The agreement among these methods in the considered interval is good. The evanescent-mode correction to the reflection coefficient is small, but the correction to the phase is quite large, attaining values of the order of 10% for ka ~1.7. The domain of applicability of the various methods is discussed. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see*: 06 Auxiliary Systems.

N64-12410 Armour Research Foundation, Chicago, Ill.
STRESSES IN THE VICINITY OF DEEP UNDERGROUND SHELTERS
C. J. Costantino, *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 55-85 refs (See N64-12407 04-01)

The results of an investigation of stress distribution about unlined cavities are presented for use in the design of deep underground tunnel problems. Stress concentration factors are presented for both two- and three-dimensional problems, together with a discussion of the effects of both anisotropy of material properties and dynamic loads. Design recommendations are made for three-dimensional problems for which no theoretical solutions exist, namely, tunnel intersections, bends, and shafts. Preliminary results of a recent experimental program on these special problems are also included. Author

N64-12645 Princeton U., N.J.
THE DEVELOPMENT OF A SMALL MACH 10 HYPERSONIC WIND TUNNEL
N. A. Zarin and I. E. Vas Mar. 1963 33 p refs
(AF Grant AFOSR-112-63; Contract AF 49(638)-465)
(Rept. 666; AFOSR-5329; AD-424293)

A hypersonic wind tunnel has been constructed at the Gas Dynamics Laboratory using air as the working fluid. This tunnel, capable of operating from Mach 5 to 10 at Reynolds numbers per inch of 0.03 to 0.40 million, has a test section diameter of 3 1/4 inches. The key part of the installation is a storage heater which consists of a coil of heavy-walled Inconel pipe which is preheated electrically to the desired stagnation temperature. A maximum temperature of 2,000° R at a pressure of 1500 psia is generated for running times of 6 to 12 minutes. Preliminary calibration tests using conical nozzles at M = 7 and 10 have verified the basic design and operating range. Author

N64-12708 Aerospace Corp., El Segundo, Calif.
METHODS FOR OPTIMIZING RADAR STATION LOCATIONS IN RELATION TO SATELLITE TRACKING
A. S. Mager 7 Aug. 1963 65 p
(Contract AF 04(695)-169)
(SSD-TDR-63-246; TDR-169(3540-20)TM-3; AD-422671)

Two methods have been derived to aid in optimizing satellite tracking station locations. Method I determines the percentage of time a satellite is within range of a ground tracking station. Method II determines the number of satellite sightings made per day by a ground tracking station. Both methods can be expanded to determine the locations of stations for best overall coverage if the frequency distribution of future satellite orbit inclinations is known. Author

N64-12775 Joint Publications Research Service, Washington, D.C.
MODIFIED TVV-TYPE FURNACE WITH TUNGSTEN HEATING ELEMENTS FOR INVESTIGATIONS AT TEMPERATURES UP TO 2800°C
V. Ya. Chekhovskoy and A. Ye. Sheyndlin *In its* Structural Defects of Germanium and High-Temp. Lab. 24 Dec. 1963 p 11-13 refs (See N64-12773 04-01)

A redesigned furnace is described. The diameter of the tungsten heater was reduced from the original diameter of 65 mm to 45 mm which, in turn, reduced the radiation surface approximately 1 1/2 times. The double wall of the heater, in the form of two coaxial cylinders, was made from tungsten wires. The shielding was strengthened. Most of the cylindrical screens (shielding) were supported on a cylindrical box made of sheet molybdenum, which had a small area of contact with the polarized molybdenum disc lying on the current lead. In addition, supplementary shielding was provided for the heater contacts and upper current lead. An inert argon atmosphere was created in the furnace for producing temperatures above 2000° C. These described changes in furnace design and the use of an inert argon atmosphere made it possible to raise the temperature of enthalpy and heat-capacity investigations of solid substances by almost 500° C, and to reach 2820° C at the required power—~43 kw. I.v.L.

N64-12874* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD FOR SIMULATING ZERO-GRAVITY ERECTION OF SATELLITE APPENDAGES
Richard W. Forsythe Washington, NASA, Jan. 1964 15 p ref (NASA TM X-937) OTS: $0.50

Equations are developed which show an analytical approach to simulating the O-g impact loading of satellite swinging booms. The equations are obtained by simple manipulation of the equations of motion and the kinetic and potential energies involved, and are verified by data from the actual spin tests of the International Ionosphere Satellite Ariel I (1962 α1). Author

N64-12879 American Inst. of Aeronautics and Astronautics, New York, N.Y.
TESTING OF MANNED FLIGHT SYSTEMS
[Dec. 1963] 129 p refs Papers presented at the AIAA/AFFTC/NASA FRC Testing of Manned Flight Systems Conf., Edwards AFB, Calif., 4-6 Dec. 1963
(Sponsored by NASA, AIAA, and AFFTC) AIAA: $3.00 members, $6.00 nonmembers

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17. A GENERALIZED APPROACH TO REAL TIME FLIGHT TEST DATA P. J. Sehnert (AFFTC) p 114-123 refs

N64-12880 American Inst. of Aeronautics and Astronautics New York, N.Y.
AN ADVANCED METHOD FOR AIRBORNE SIMULATION
Herman A. Rediess and Dwain A. Deets *In its* Testing of Manned Flight Systems [Dec. 1963] p 33-39 refs (See N64-12879 04-01) AIAA: $3.00 members, $6.00 nonmembers

Some of the results are presented of studies leading to the design and development of a General-Purpose Airborne Simulator (GPAS) to support the supersonic transport program and to perform general research. The response-feedback and the

model-controlled concepts for an airborne simulator are discussed and evaluated. The model, following performance of the system designed for the GPAS, and the other results believed to be generally applicable are also discussed. C.L.W.

N64-12881 American Inst. of Aeronautics and Astronautics, New York, N.Y.
UTILIZATION OF EXISTING AIRCRAFT IN SUPPORT OF SUPERSONIC-TRANSPORT RESEARCH PROGRAMS
Thomas R. Sisk and William H. Andrews *In its* Testing of Manned Flight Systems [Dec. 1963] p 67–76 (See N64-12879 04-01) AIAA: $3.00 members, $6.00 nonmembers

Three programs are discussed which the NASA Flight Research Center has initiated, utilizing existing high-performance aircraft to investigate some of the problems predicted in the supersonic-transport operational environment. The three programs discussed are: a minimum-flight-speed investigation utilizing an F5D aircraft; air-traffic control compatibility program utilizing an A5A aircraft; and specific vehicle research on the XB-70 aircraft. The F5D fulfilled the requirements for investigating the minimum-speed flight regime of a high-performance, low-aspect-ratio configuration; the A5A aircraft had the necessary performance capability to qualify for the air-traffic control compatibility program; and the XB-70 aircraft represented the latest development in large, flexible, supersonic cruise aircraft. C.L.W.

N64-12882 American Inst. of Aeronautics and Astronautics, New York, N.Y.
A SIMULATION SYSTEM FOR THE MANNED SPACEFLIGHT GROUND-SUPPORT NETWORK
L. L. Ruetz and Armistead Dennett *In* NASA, Flight Test Center AIAA/AFFTC/NASA FRC Testing of Manned Flight Systems [Dec. 1963] p 109–113 (See N64-12879 04-10)
AIAA: $3.00 members, $6.00 nonmembers

The simulation system for ground operational support of future manned spaceflight is discussed. Simulation requirements of the support system, the simulating system, and the operating modes of the system were included. The simulation system will provide means of conducting training of ground control personnel for the network, and in connection with a spacecraft flight crew trainer, will permit realistic training of ground and spacecraft crews simultaneously. C.L.W.

N64-13134 Sperry Gyroscope Co., Great Neck, N.Y.
EXPERIMENTAL EVALUATION OF COMPATIBLE PWI/CAS INTERROGATOR-TRANSPONDER TECHNIQUES, VOLUME 1 OF 2 Interim Report
Sep. 1963 76 p refs
(Contract FAA/ARDS-444)
(EB-5261-0341-1)

The results of an experimental evaluation of interrogation-transponder techniques are presented as applied to the airborne Pilot Warning Indicator (PWI) and Collision Avoidance System (CAS) problem. The experimental program covered the fabrication of breadboards of the coding, decoding, and computing portions of the system and the laboratory evaluation of these breadboards in a simulated real world environment. This simulation included injecting into the system, background interference anticipated for the operational period due to the transmissions of other PWI and CAS. A systems analysis indicated that several changes in the system threshold levels were desirable. A study of the effect of sidelobes indicated that the minimum range limit (the range at which warnings are displayed regardless of the encounter geometry) should be increased to eliminate the possibility of a dangerous situation arising in very low closing rate encounters. Revised values of the impending miss distance at the threshold point at 40 seconds to collision are: 1/2 nm for velocities below 300 knots, 1.5 nm for velocities below 800 knots, and 3 nm for velocities below 1700 knots. I.v.L.

N64-13150 Advisory Group for Aeronautical Research and Development, Paris (France)
RADIO NAVIGATION SYSTEMS FOR AVIATION AND MARITIME USE. A COMPARATIVE STUDY
W. Bauss, ed. Oxford, New York, Pergamon Press, 1963 213 p refs
(AGARD-63)
Available from Pergamon Press: 70s

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1. INTRODUCTION H. C. Freiesleben p 1–15 refs
2. DESCRIPTIONS OF THE SYSTEMS W. T. Runge et al p 17–151 refs
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N64-13172 Advisory Group for Aeronautical Research and Development, Paris (France)
IMPLICATIONS OF RECENT INVESTIGATIONS ON RUNWAY ROUGHNESS CRITERIA
Thomas L. Coleman and Albert W. Hall (NASA, Langley Res. Center) Jan. 1963 25 p refs
(AGARD-416)

Results obtained from recent National Aeronautics and Space Administration investigations of runway roughness are discussed. These results are used to assess the adequacy of runway roughness criteria based on power spectral density techniques. In addition, an analytical method for studying repairs to unsatisfactory runways is described. Author

N64-13222 Union Carbide Nuclear Co., Oak Ridge, Tenn.
A SINGLE STAGE AXIAL COMPRESSOR BLADE TEST FACILITY
G. G. Fee 13 Jan. 1964 49 p refs
(Contract W-7405-eng-26)
(K-1568) OTS: $1.25

This facility, formally known as the Research Compressor Test Facility, has the instrumentation and equipment required to evaluate the performance of axial blades requiring maximum power inputs of 2500 hp and rotational speeds up to 23,000 rpm in a 14.5-in.-diam. test section. Covered in this report are building layout, instrumentation, utilities, drive train and blade inspection equipment. Author

N64-13224 Argonne National Lab., Ill.
ARGONNE NATIONAL LABORATORY RADIOLOGICAL ASSISTANCE TEAM
G. T. Lonergan and W. H. Smith Oct. 1963 38 p
(Contract W-31-109-eng-38)
(ANL-6786)

The Laboratory's Radiological Assistance Team organization and methods of training, operations, equipment, and utilization are discussed. Author

N64-13287* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE USE OF A CONVENTIONAL WIND TUNNEL AS A MULTIGAS FACILITY
Howard Koester, Gilbert Herrera, and Donald Hanks 8 Apr. 1963 17 p refs
(NASA Contract NAS7-100)
(NASA CR-53010; JPL-TM-33-145) OTS: $1.60 ph, $0.80 mf

This report presents the results of utilizing the 21-in. hypersonic and 20-in. supersonic wind tunnels as continuous flow multigas facilities. Carbon dioxide (CO_2) was used as the contaminating gas. Concentrations up to 70% by volume of CO_2 were obtained at Mach numbers 2.6 and 6.0. The techniques, special equipment, instrumentation used, and results are discussed. This study is of particular interest since aerodynamic testing in atmospheres approximating those of Venus and Mars appears to be feasible in facilities originally designed to use air as the working fluid. Author

N64-13297 Aircraft Research Assn. Ltd., Bedford (Gt. Brit.)
NEW EQUIPMENT FOR AERODYNAMIC BALANCE CALIBRATION AT THE ONERA TEST CENTER OF MODANE
M. Dubois Nov. 1963 20 p refs Transl. into ENGLISH from La Recherche Aeronautique, No. 92 Jan.–Feb. 1963

The general characteristics of the balances for three Modane wind tunnels and the general calibration principles are given. The new calibration equipment allows maximum loads of about one ton, and its particular feature is that it permits compensation for deformation under loads. The method utilized increases accuracy and, as soon as calibration is over, provides the processed data—the influence coefficients of the six aerodynamic components on the output of the balance pickups. Author

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-12408 California U., San Diego
TRANSIENT RESPONSE OF A FLUID-SOLID INTERFACE DUE TO AN IMPULSIVE PRESSURE-POINT SOURCE
Freeman Gilbert *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 1–37 refs (See N64-12407 04-01)
(Contract DA-49-146-XZ-073)

Analysis is made of the motion of a point in a semi-infinite solid resulting from an impulsive point source of pressure in a semi-infinite fluid elastic medium and at a distance z from the interface. An empirical method is given for relating the results to the problem of blast loading on air–earth interface. Author

N64-12491 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Lab.
STABILITY OF AN ELASTIC BAND IN A GAS FLOW
R. Ye. Lamper *In its* News of Higher Educational Inst., Aviation Technol. 20 Sep. 1963 p 1–5 refs (See N64-12490 04-01)

The critical rate at which a gas flows around an elastic band was determined by mathematical examination of a band of infinite elasticity, with gas flows on both sides at a given velocity. R.T.K.

N64-12690* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE DIRECT SOLUTION OF THE GOVERNING EQUATION FOR RADIATION-RESISTED SHOCK WAVES
Walter E. Pearson Washington, NASA, Jan. 1964 18 p refs (NASA TN D-2128) OTS: $0.50

This investigation is concerned with the singular, nonlinear, integral equation that arises in the theoretical study of inviscid, radiation-resisted shock waves without heat conduction. A simple iterative technique is given for the solution of this equation. Sufficient conditions for the convergence of the iteration are given, and the technique is then applied to two examples with different shock and radiation strengths. When the velocity profiles obtained are compared with earlier results which adapt a specialized approximation from astrophysics, very close agreement is revealed. Author

N64-12716* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROXIMATE CALCULATION OF HYPERSONIC CONICAL FLOW PARAMETERS FOR AIR IN THERMODYNAMIC EQUILIBRIUM
Perry A. Newman Washington, NASA, Jan. 1964 17 p refs (NASA TN D-2058) OTS: $0.50

An approximate algebraic solution for equilibrium flow derived from Dorodnitsyn's integral method is used to compute flow parameters for circular cones at zero incidence in air that is free of argon and carbon dioxide. The air between the shock wave and cone surface is assumed to be in local thermal and chemical equilibrium. Comparison of 44 test cases of the algebraic solution with a numerical integration of the exact Taylor–Maccoll equation gave average errors of less than 1 percent in the velocity, pressure, density, and temperature on the cone surface and in the shock-layer thickness. For these cases the cone semivertex angle ranged from 20° to 50°, the free-stream velocity from about 10,000 to 32,000 fps, and the free-stream pressure from 10^{-4} to 10^{-1} atm. The free-stream temperature was held at 291.69° R. Required inputs are the cone semivertex angle and free-stream velocity, pressure, density, and ratio of specific heats. In the program, values of pressure, density, velocity, temperature, and compressibility factor, both behind the shock wave and on the cone surface, are computed. Author

N64-12976 Don Bosco Inst. for Research, Ramsey, N.J.
THE VIBRATION OF A HOMOGENEOUS PLATE WITH LINEAR DAMPING, RADIATING INTO A FLUID MEDIUM
V. L. Salerno and Irving W. Jones Nov. 1963 65 p refs
(Contract Nonr 4199(00))
(AD-423762)

Stress–strain relations incorporating linear, frequency independent damping, the type characteristic of structural metals, have been employed in deriving an equation of motion for a plate in an acoustic medium. Two sets of boundary conditions are considered. An infinitely long plate, simply supported along its two edges is analyzed. It is assumed that the plate is set between infinite walls with different fluids occupying the spaces above and below the plate. A sound wave travels through the first medium, strikes the plate, sets it into vibration, and causes reradiation of sound into the second medium. The second plate considered is a rectangular plate, simply supported along two opposite edges, free along

the other two, and again set between infinite walls. This plate has a harmonic force acting on one side and radiates sound waves into a medium on the other. The effectiveness of the plates for damping out vibratory energy is measured by a "pressure ratio". This quantity is calculated for a number of situations in a numerical example. The calculations showed the effect of structural damping to be of small order for metallic homogeneous plates. Author

N64-13021 Brown Engineering Co., Huntsville, Ala. Engineering Dept.
A REVIEW OF FLOW IN CURVED DUCTS AND A PROPOSED CROSS-SECTIONAL SHAPE TO REDUCE ENVIRONMENTAL EFFECTS ENCOUNTERED WITH HIGH ENTHALPY FLUIDS
G.R. Guinn Dec. 1963 37 p refs
(Tech. Note R-77)

The characteristics of fluid flow in curved ducts are briefly reviewed. The primary emphasis is placed upon the effects of flow turning on the duct structure when the fluid is a gas at elevated temperatures and contains a suspension of condensed phases. A duct cross-sectional shape is proposed to reduce the environmental effects on the structure at the elbow outer wall. Author

N64-13052 Massachusetts Inst. of Tech., Cambridge Engineering Projects Lab.
FLOW OSCILLATIONS IN A CLOSED LOOP WITH TRANSPARENT, PARALLEL, VERTICAL, HEATED CHANNELS
S. William Gouse, Jr. and Carl D. Andrysiak 24 Jun. 1963 56 p refs
(NSF-Grant 11355; NSF Grant 19771)
(MIT-8973-2)

A closed loop, incorporating three, transparent, resistance heated, parallel, vertical, test sections, 0.430 in. ID and 60 in. long was built to permit the visual and quantitative study of forced and natural flow oscillations. The test fluid was Freon 113. Various possible mechanisms for starting the driving of the flow oscillations were investigated. The major conclusions of this study are: (1) Boiling must be taking place in the test sections for flow oscillations to occur. (2) The superheat necessary to start boiling and its resulting initial flashing leads to periodic flow oscillations only if other conditions are appropriate, i.e., starting in an unstable region. (3) It is possible to prepare a useful and usable stability map by plotting the test section inlet subcooling versus the test section flow rate at the onset of instability for constant heat flux, system geometry, and condenser pressure. (4) The range of periods of flow oscillations measured is the same order as the range of natural periods calculated for the system. Author

N64-13055* Alabama U. Research Inst., Huntsville
HYPERSONIC FLOW WITH NON-EQUILIBRIUM DISSOCIATION AROUND BLUNT BODIES IN FLOW FACILITIES AND IN FREE FLIGHT Research Report No. 8
Rudolf Hermann and Janardanarao Yalamanchili (Ph.D. Thesis) Oct. 1963 28 p refs Presented at the Ann. Meeting of the Wiss. Ges. für Luft- und Raumfahrt, Munich, 8–12 Oct. 1963
(NASA Grant NsG-381)
(NASA CR-55138) OTS: $2.60 ph, $1.04 mf

An investigation was made of high enthalpy, nonequilibrium nozzle flow of air. Results are given for supply temperatures of 4000° to 6000° K and for supply pressures of 10 to 100 atmospheres. Results indicated that high temperature airflow in hypersonic wind tunnels is frozen beyond a cross section where Mach number 2 or 3 is reached, because of the rapid expansion of the gas downstream of the nozzle throat. The flow field around a circular cylinder up to the sonic point, the shock shape, and the shock detachment distance were determined. The hypersonic nozzle flow was investigated, and the degree of oxygen dissociation along the hypersonic nozzle was calculated. Both equilibrium and nonequilibrium flow calculations are given. A calculation was made of the nonequilibrium hypersonic flow around a blunt body in dissociated air. Numerical equations are given in the proper form both for the sphere and the circular cylinder. Numerical calculations, however, were done only for the two-dimensional case of the circular cylinder, and they were carried out on the GE-225 computer. R.T.K.

N64-13081 Linde Co., Tonawanda, N.Y.
RESEARCH ON RHEOLOGIC AND THERMODYNAMIC PROPERTIES OF SOLID AND SLUSH HYDROGEN Quarterly Report No. 1, 15 Jun.–15 Sep. 1963
Robert F. Dwyer and Gerhard A. Cook [1963] 29 p refs
(Contract AF 33(657)-11098)
(AD-423643)

Recent data from the literature on the melting pressures of parahydrogen up to 400 atm are given. The heat of fusion of parahydrogen has so far been determined under only a single set of conditions (those of the triple point); it is 28.08 ±0.15 cal/g.mole. Theoretical values for the heat of fusion at the triple point and at pressures up to 160 atm have been calculated. At the triple point the calculated value differs from the experimental value by only 1.1%. Design of the first cryostat and design of the calorimeter to be used for determining the heat of fusion of solid parahydrogen along the melting curve have been completed. Fabrication and installation have been completed for the following: the Plexiglas safety case and its supports and vent lines, the heat closure, the inner dewar, and the rack to support the equipment which is outside the case. Author

N64-13110 Emmanuel Coll., Boston, Mass. Research Language Center
NON-STEADY LAMINAR FLOW OF AN INCOMPRESSIBLE VISCOUS FLUID IN CIRCULAR CYLINDRICAL PIPES [ZUR INSTATIONAREN, LAMINAREN STROMUNG EINER INKOMPRESSIBLEN, ZAHEN FLUSSIGKEIT IN KREISZYLINDRISCHEN ROHREN]
Werner Gerbes [1962] 18 p refs Transl. into ENGLISH from Z. Angew. Phys. (W. Berlin), v. 3, no. 7, 1951 p 267–271
(Contract AF 19(604)-8505)
(ETG-G-63-16; AD-414737)

Using the Laplace transformation the following were investigated: (1) the initial process for the sudden application of a constant pressure upon a circular cylindrical pipe filled with an incompressible viscous fluid; (2) the dying out of the flow after the pressure is suddenly removed; (3) the steady-state condition under the influence of a harmonically vibrating pressure upon the pipe. Author

N64-13120 Polytechnic Inst. of Brooklyn, N.Y.
SOME PERTURBATION SOLUTIONS IN LAMINAR BOUNDARY LAYER THEORY PART II: THE ENERGY EQUATION
Herbert Fox and Paul A. Libby Oct. 1963 103 p
(Contract AF 49(638)-217)
(PIBAL-752; AD-425768)

Solutions for two types of problems involving the energy equation for flows with velocities described by the Blasius solution are presented. The first type arises in flows with initial, arbitrary distributions of stagnation enthalpy and with surfaces downstream of the initial station either with constant

wall enthalpy or with zero heat transfer. Exact solutions in these cases are obtained for $\rho\mu$ ration, and Prandtl number of unity; they are given in terms of complete orthogonal sets of functions which can be used to obtain first and higher order corrections for the effects of variable $\rho\mu$ product, nonunity Prandtl number, and deviations of the velocity field from that described by the Blasius solution. The second type of problem pertains to flows with power law descriptions of the wall enthalpy. Again the basic solutions are obtained for Prandtl number of unity, and the effect of nonunity Prandtl number is treated as a perturbation. Author

N64-13214 California U., Berkeley. Lawrence Radiation Lab.
LONGITUDINAL DISPERSION IN PACKED EXTRACTION COLUMNS WITH AND WITHOUT PULSATION
Joon S. Moon, Alphonse Hennico, and Theodore Vermeulen
23 Oct. 1963 128 p refs
(Contract W-7405-eng-48)
(UCRL-10928) OTS: $2.50

This research was conducted to develop design information that will take longitudinal dispersion into account for packed-column extraction. Single-phase Péclet numbers were measured by an unsteady-state step-input method. For pulsed columns, the use of pulsation serves to decrease the Péclet numbers as the amplitude increases, and to a lesser extent as the frequency increases. The effect is somewhat more pronounced in beds of Raschig rings and Berl saddles than in beds of uniform spheres. The Péclet-number decrease diminishes with increasing fluid viscosity and also with increasing flow rate; results indicate a rise in Péclet number for viscous fluids. For unpulsed columns, Péclet numbers in the low-Reynolds-number regime down to a Reynolds number of 0.04 were obtained, using 0.0058-in.-diam. glass beads as a packing material. The modified Péclet number P remained constant at 0.205 ±0.020. Péclet numbers for counterflowing liquid-liquid systems were measured for both continuous and dispersed phases, with the behavior of the latter depending upon whether it does or does not wet the packing material. Author

N64-13268* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE STRUCTURE OF STRONG SHOCK WAVES IN THE KROOK COLLISION MODEL
Moustafa T. Chahine Repr. from 3rd Intern. Rarefied Gas. Symp., v. 1, New York, Academic Press, 1963 p 260–273 refs (See N63-21571)
(NASA Contract NAS7-100)
(NASA CR-53019; JPL-TR-32-327)

The Krook collision model (in the absence of external forces), $\delta f/\delta t + v(\delta f/\delta x) = An(F - f)$ in which the form A is approximated in terms of the local collision frequency, is used. The distribution function through the shock is determined by using different representations for f in the two regions of velocity space, and $v_x < 0$ and $v_x > 0$ iterative method is then established utilizing the Navier–Stokes solution as a basis of iteration. The solution is further applied to compute the velocity and temperature profiles for steady-plane shock waves in a monoatomic gas for Mach number $1 \leq M \leq 10$. These results provide, on the one hand, some insight into the range of validity of the various approximation methods and, on the other hand, a check on the usefulness of Krook's collision model in this problem. The conclusions derived from these results confirm the expectation that any correct theory should reproduce the Navier–Stokes solution at low Mach numbers. At higher Mach numbers, only future experimental and theoretical work can show how accurate these deviations are. I.v.L.

N64-13292 Argonne National Lab., Ill.
TWO-PHASE CRITICAL FLOW WITH APPLICATION TO LIQUID-METAL SYSTEMS (MERCURY, CESIUM, RUBIDIUM, POTASSIUM, SODIUM, AND LITHIUM)
Hans K. Fauske Oct. 1963 51 p refs
(Contract W-31-109-eng-38)
(ANL-6779)

Existing data and models for critical two-phase flow of steam–water mixtures are examined. One model in particular shows considerable success in predicting the phenomena of critical flow. A Fortran program for an IBM-704 digital computer, for the application of this model to predict void fraction, slip ratio, and critical flow rates to the flashing flow for various liquid-vapor metal systems in pipes when the conditions are such that critical flow may be experienced, was developed. Calculations have been made for the following liquid-metal systems: mercury (temperature range, 450° to 1600° F), cesium (temperature range, 500° to 2300° F), rubidium (temperature range, 500° to 2300° F), potassium (temperature range, 900° to 2500° F), sodium (temperature range, 950° to 2500° F), and lithium (temperature range, 2000° to 3500° F). The vapor fraction or quality ranges from 0% to 100%. Author

N64-13302 Hydronautics, Inc., Laurel, Md.
A COMPARATIVE EVALUATION OF CAVITATION DAMAGE TEST DEVICES
A. Thiruvengadam Nov. 1963 33 p refs
(Contract Nonr 3755(00))
(Tech. Rept. 233-2; AD-425725)

The intensity of cavitation damage is defined as the power absorbed per unit area of the damaged material surface. It is estimated by multiplying the average depth of erosion per unit time by the strain energy of the material. The intensity of cavitation damage of the A.S.M.E. Standard Magnetostriction Device is approximately one erg/sec/cm^2 (i.e., 10^{-7} w/cm^2). Similarly the intensity of the rotating disk device used by the author is also one erg/sec/cm^2. The most intense laboratory device so far used is the rotating disk device of Rasmussen. The least intense device is the Verturi-type flow device used by Hammitt. These results contradict the popularly held view that the so-called "accelerated" damage devices are more intense than the rotating disk device. This leads to the conclusion that the cavitation damage produced by field devices may sometimes be as intense as that produced by the magnetostriction devices. Author

N64-13331 National Aeronautical Lab., Bangalore (India)
PRESSURE LOSSES IN SCALE-MODELS OF U-BENDS AND Y-JUNCTIONS OF NAL AIR RECEIVER SYSTEM
H. C. Seetharam Apr. 1963 32 p ref
(TN-AE-15-63)

Experiments were performed on scale models of ducts of the NAL air storage system to determine the total pressure losses in some of the critical components in the system, namely, the 45° bend, the Y-junction and the U-bend followed by a wide-angle conical expansion. It is observed that the 45° bend with a 3-ft entry diameter leading to the 4-ft diameter header pipe shows considerably greater nonuniformity of flow at exit than the model with a 4-ft diameter throughout; the former gives poor flow diffusion and results in greater energy loss. Hence the latter design was adopted for the Y-junction. It is found that the pressure losses are within tolerable limits. Author

N64-13333* Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE EFFECT OF SPECIES DIFFUSION AND HEAT CONDUCTION ON NONEQUILIBRIUM FLOWS BEHIND STRONG SHOCKS
W. E. Gibson and J. D. Buckmaster Oct. 1963 58 p refs (NASA Contract NASr-119)
(NASA CR-55178; CAL AG-1729-A-3) OTS: $5.60 ph, $1.94 mf

The effects of species diffusion and heat conduction are investigated for nonequilibrium flows behind strong one-dimensional shocks. The relaxation zone is analyzed separately from the shock transition zone for translational (and rotational) temperature. It is shown that transport processes effectively decrease the high concentration and temperature gradients in the relaxation zone of strong shocks. This specific nonequilibrium behavior is studied for both vibration and dissociation. Strong effects are noted at shock speeds of 20 kft/sec (for vibration) and 29 kft/sec (for dissociation). Preliminary results are also given for airflows with coupled chemistry. A method for including the effects of free stream dissociation is presented for flows involving transport processes. The applications to bow shock flows at high reentry speeds are pointed out. Author

N64-13347 Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (W. Germany) Inst. fur Theoretische Gasdynamik
ANALYTICAL CALCULATION OF AXISYMMETRICAL SUPERSONIC FLOWS WITH SHOCK [ANALYTISCHE BERECHNUNG ACHSENSYMMETRISCHER UBERSCHALLSTROMUNGEN MIT STOFZEN]
Wilhein Schneider (Ph.D. Vienna) Oct. 1963 108 p refs in GERMAN
(DVL-275)

An analytical theory of the stationary isentropic axisymmetrical supersonic flow is presented and applied to the flow around various bodies of rotation. The characteristic coordinates are the independent variables. These coordinates are magnitudes which are constant at Mach lines. The entropy and the locus coordinates are developed according to the exponent of the interference parameter. Compression shocks and angular expansions are included in the calculations.
Trans. by I.v.L.

N64-13361 Aeronautical Research Council (Gt. Brit.)
AN ANALYSIS OF TWO-DIMENSIONAL TURBULENT BASE FLOW, INCLUDING THE EFFECT OF THE APPROACHING BOUNDARY LAYER
J. F. Nash London, HMSO, 1963 40 p refs
(ARC-R&M-3344; supersedes NPL-AERO-1036, ARC-24000) Available from HMSO: 15s 6d

The present position of the theory of supersonic turbulent base flow is reviewed, and arguments are put forward which suggest that the theory of Korst and others is incorrect in certain respects. The analysis of two-dimensional turbulent base flow is formulated on the basis of a modified recompression criterion which is more consistent with experimental observation than the one previously used. At supersonic speeds examples are submitted to illustrate the use of the theory to predict the effect of an approaching boundary layer on base pressures, and satisfactory agreement with measurements is obtained so long as the thickness of the boundary layer is small. The theory is also shown to account for certain features of the steady base flow at subsonic and transonic speeds, e.g., the abrupt fall in base pressure which occurs near sonic velocity. Author

N64-13386 Aeronautical Research Council (Gt. Brit.)
THE FORCES ON A CYLINDER IN SHEAR FLOW
A. Thom London, HMSO, 1963 9 p refs
(ARC-R&M-3343; supersedes ARC-23930) Available from HMSO: 4s

An arithmetical solution is obtained for the viscous creeping flow past a circular cylinder on the bottom of a channel roughly two-diameters deep. The top of the channel is assumed to be in uniform motion so a shear layer exists in the undisturbed channel. The drag of the cylinder is found to be equivalent to 29 times the floor drag on an area equal to the projected area of the cylinder. The resultant vertical force on the cylinder is zero. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-12411 General American Transportation Corp., Niles, Ill. MRD Div.
RADIOGRAPHIC OBSERVATION OF DYNAMIC SOIL PHENOMENA
F. H. Bloedow *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 86–91 refs (See N64-12407 04-01)

This paper discusses two radiographic techniques which have been used to observe dynamic soil behavior. The first technique employs a constant potential X-ray machine and a moving film recording technique; the second technique uses a flash X-ray source and image intensifier and camera recording system. Author

N64-12412 Black and Veatch Consulting Engineers, Kansas City, Mo.
THE STATIC LIMITS OF DISTORTION OF TUNNELS SUBJECTED TO DYNAMIC BLAST LOADS
Harry L. Callahan *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 92–105 refs (See N64-12407 04-01)

This paper develops a procedure for determining the probable deflection which will occur under dynamic blast loading on a structure (tunnel section) which has already been distorted out-of-round as a result of static loading. Normal static design and dynamic design procedures for buried tunnel sections are reviewed. Static failure criteria are reviewed, and a procedure is presented for determining the maximum allowable static distortion of a tunnel section which will not fail during or subsequent to dynamic blast loading. The modulus of horizontal subgrade reaction is determined from the amount of deflection that has occurred in the distortion of the structure due to static loading. The vertical modulus of deformation is determined by utilizing the modulus of horizontal subgrade reaction. From the vertical modulus of deformation the vertical displacement of an equivalent earth column under blast load is obtained. The vertical displacement is compared to the calculated dynamic deflection of the tunnel section. Author

N64-12413 Massachusetts Inst. of Tech., Cambridge
EFFECTS OF VISCOSITY AND INELASTICITY UPON STRESS WAVES THROUGH CONFINED SOIL
Robert V. Whitman *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 107–123 refs (See N64-12407 04-01)

This paper assesses the probable influence of nonelastic effects upon the accuracy of prediction formulas and upon the question of stress attenuation with depth. It combines theoretical and experimental results to show that elastic ground motion prediction formulas are generally valid; i.e., the possible effects of viscosity and inelasticity are no greater than uncertainties as to the order of magnitude of the compressibility of an *in situ* soil mass. Author

N64-12422 Alaska U., College Geophysical Inst.
RESULTS OF THE TRANSARCTIC "PINWHEEL" EXPERIMENT
Johannes Ortner (Kiruna Geophys. Obs.) *In its* Arctic Propagation Studies at Ionospheric Modes of Propagation May 1963 p 19–23 (See N64-12420 04-01)

The 18 mc/s transarctic circuit was found to be more sensitive to auroral-zone absorption events than to the polar-cap absorption events of August 1959. This behavior together with multipath reception of the 18 mc/s signal at Kiruna, Sweden, pointed to the existence of unconventional propagation modes, including a nongreat circle path which is laterally deviated in the auroral zone. The results of a "pin-wheel" (a specially designed, three-element Yagi for 18 mc/s) experiment made in Kiruna during 1961–62 to explore this mode were inconclusive. R.T.K.

N64-12423 Alaska U., College Geophysical Inst.
COLLEGE-KJELLER AND THULE-KJELLER PROPAGATION PATH ANALYSES
K. Folkestad (Norwegian Defense Res. Estab.) *In its* Arctic Propagation Studies at Ionospheric Modes of Propagation May 1963 p 24–63 (See N64-12420 04-01)

The signal behavior on the College, Alaska–Kjeller, Norway; and on the Thule, Greenland–Kjeller circuits during the 18-month period of January 1961 through June 1962 is discussed by means of typical record samples, summary graphs, and plots of the seasonal variations during selected quiet days. The circuit behavior during disturbed periods was studied in detail and related to absorption measurements and magnetic K-indices. A discussion is also presented of around-the-world echo signals. R.T.K.

N64-12424 Alaska U., College Geophysical Inst.
ANALYSIS OF HF CISPOLAR AND TRANSPOLAR PROPAGATION PATHS
R. D. Hunsucker *In its* Arctic Propagation Studies at Ionospheric Modes of Propagation May 1963 p 64–89 (See N64-12420 04-01)

The relationship between signal propagation over the transarctic and arctic paths and simultaneous ionospheric absorption was studied. Good correlation was found between strong polar-cap absorption events and signal blackout on 12 and 18 mc/s, whereas auroral-zone absorption was found to affect the Thule, Greenland–College, Alaska 18 mc/s circuit systematically. Some synchronized 6- to 64-mc/s oblique step-frequency transmissions between Kjeller, Norway and College are discussed with particular attention to the lowest observable frequency and oblique absorption. The maximum observable frequency for the path is compared with the maximum usable frequency deduced from vertical soundings at Resolute Bay, Canada. The maximum observable frequency was found to be consistently greater than the predicted maximum usable frequency. R.T.K.

N64-12500 Science Council of Japan, Tokyo
POST-IGC DATA ON ATMOSPHERICS, WHISTLERS AND SOLAR RADIO EMISSIONS, VOLUME IX, FROM 1 JULY TO 31 DECEMBER 1961
A. Kimpara, H. Ishikawa, K. Sao, and H. Tanaka, comp. 1963 231 p

Data are presented in the following areas: (1) atmospheric average intensity—integrated intensity of atmospheric radio noise, monthly average and sudden enhancements of atmospherics; (2) intensity of atmospheric radio noise—integrated intensity of atmospheric radio noise, hourly value; (3) atmospheric noise recording; (4) monthly return for narrow sector bearing; (5) atmospheric radio noise data by statistical method; (6) sferics fixes and waveforms of atmospherics; (7) whistler data; and (8) solar radio emissions. P.V.E.

N64-12502 Joint Publications Research Service, Washington, D.C.
RADIO INVESTIGATIONS OF THE STRUCTURE OF THE IONOSPHERE BY MEANS OF KOSMOS ARTIFICAL EARTH SATELLITES AT COHERENT FREQUENCIES; PRELIMINARY RESULTS
Ya. L. Al'pert, V. B. Belyanskiy, and N. A. Mityakov *In its* Transl. from Geomagnetizm i Aeronomiya [Moscow, v. 3] no. 1, 7 May 1963 p 1–27 refs (See N64-12501 04-01) OTS: $1.50

Results of preliminary analysis of measurements of differences in the Doppler shift in the frequencies of coherent radio transmissions from Cosmos I and II, at frequencies of 20.005 and 90.0225 mc/s, are presented. The theoretical formulas and data-processing methods used are discussed. Large-scale horizontal gradients of the electron concentration were found to play a large role in the ionosphere. The sizes of the large-scale latitudinal inhomogeneities were found to vary from 100 to 500 km, and the gradients of electron concentration were found to be about (1 to 5) x 10^3 el/cm^3/km. New data obtained on the angle of refraction of radio waves in the ionosphere show that this angle changes significantly during passage from point to point and reaches 3° to 4° at a frequency of 20 mc/s. Other results indicate that the approximation based on geometric optics may be invalidated in a number of cases, and that a more rigorous derivation of the formulas used in the data analysis may be necessary. M.P.G.

N64-12617 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON WATER PERMEABILITY OF FROZEN SAND
V. D. Komarov 11 Oct. 1963 11 p refs Transl. into ENGLISH from Materialy po Lab. Issled. Maerzlykh Gruntov, 1957 p 142–148
(FTD TT-63-927/1+2; AD-424868)

The water permeability of frozen sand was investigated in an effort to calculate the amount of thawed water which will be consumed by the frozen ground. It was concluded that when water with a temperature of 0° penetrates into the pores of frozen sand, ice crystals are formed, causing rapid heating of the sand as a result of the liberation of the latent heat of ice formation. In all experiments water permeability of sand decreased for a certain period of time from the beginning of the feeding of water into the sand, usually corresponding to an

absorption of 10 to 30 mm of water, after which it became almost constant and close to the filtration coefficient. A reduction in water permeability of frozen sand in proportion to absorption of water was found in connection with the reduction in magnitude of capillary pressure per unit of length of permeation path. C.L.W.

N64-12619 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON WATER EXCHANGE BETWEEN EARTH AND OUTER SPACE (UNIVERSE)
V. F. Derpgol'ts 11 Oct. 1963 19 p refs Transl. into ENGLISH of an article from Geogr. Sb., Geogr. Obshchestvo Soyuza SSR, (USSR), 1962 p 198–207
(FTD-TT-63-841/1; AD-425566)

This report presents various hypotheses concerning: (1) the origin of water on earth; (2) the existence of water, in all three phases, in interplanetary space; (3) the arrival of water on earth from interplanetary space; (4) the arrival of water from the terrestrial atmosphere in interplanetary space; and (5) the use of ice in space. I.v.L.

N64-12635 Hawaii Inst. of Geophysics, Honolulu
AN EVALUATION OF THE POTSDAM DATUM Scientific Report No. 1
George P. Woollard Sep. 1963 57 p refs
(Contract AF 19(628)-2849)
(AFCRL-63-710; AD-424997)

A LaCoste Romberg and a Worden geodetic gravimeter were used to connect the Potsdam international gravity base to absolute gravity sites at Washington, D.C., Princeton, N.J., Teddington, England, and Paris, France, with an indirect connection to the BadHarzburg base used in lieu of Potsdam since World War II. The BadHarzburg value was found to be 0.89 mgal high, and the Potsdam datum relative to the more modern absolute gravity values was found to be +13.6 ±1.4 mgal high. There is however an apparent systematic difference of 2.8 mgals between the new European and American absolute measurements, and if this is allowed for as a function of gravity field strength the Potsdam datum is +12.1 ±0.6 mgal high. Author

N64-12687 RAND Corp., Santa Monica, Calif.
DIURNAL VARIATION OF TEMPERATURE AND PARTICLE DENSITY BETWEEN ~100 KM AND ~500 KM
H. K. Kallmann and W. L. Sibley Nov. 1963 42 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3847-PR; AD-423617)

Rocket and satellite observations made in the U.S.A. and in the U.S.S.R. of atmospheric densities and oxygen ratios $n(O)/n(O_2)$ were used to determine the diurnal variations of pressure, temperature, and composition in the region between 100 and 500 km. The six main constituents of the earth's upper atmosphere are included: molecular nitrogen and oxygen, atomic oxygen, argon, helium, and hydrogen. The results of this investigation were obtained without assuming a temperature, scale-height, or molecular-weight gradient, as in previous investigations. It is also the first attempt to make calculations that include major and minor constituents together, based on observed composition. Consequently, it is shown how the numerical values of composition and, thus, the role of major and minor constituents, vary with altitude and from day to night. Author

N64-12691* National Aeronautics and Space Administration, Washington, D.C.
ON MOLDAVITES FROM BOHEMIA AND MORAVIA [O MOLDAVITECH CILI VLTAVINECH Z CECH A MORAVY]
F. Hanus Jan. 1964 122 p refs Transl. into ENGLISH from Rozpravy Cesk. Akad. Ved Trida II, Mat.-Prirod. (Prague), v. 37, no. 24, 1928 p 1–83
(NASA TT F-111) OTS: $2.75

The morphological details of moldavites were scrutinized over a period of 16 years in an effort to solve the problem of their origin. The results of examination of over 10,000 moldavites are reported. Author

N64-12800 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF THE FIGURE OF THE EARTH THROUGH ANOMALIES OF THE VERTICAL GRADIENT OF GRAVITY
S. V. Gromov *In its* Dust Nature of the Lunar Surface and Determining Figure of the Earth Through Gravity Anomalies 15 Jul. 1963 p 10–19 ref (See N64-12798 04-01) OTS: $0.75

Assuming an instrument to measure the vertical gradient of gravity will become available in the near future, a method for determining the figure of a regularized geoid using the vertical gradient is proposed. M.P.G.

N64-12925 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
ATMOSPHERIC STRUCTURE, WHITE SANDS MISSILE RANGE, NEW MEXICO. PART I: SURFACE WIND, CLOUD COVER, VISIBILITY
Marjorie Mc Lardie Hoidale Nov. 1963 227 p
(ERDA-88; AD-423156)

A statistical analysis of surface wind velocity, sky condition, and visibility is presented for "A" Station, White Sands Missile Range, New Mexico. Author

N64-12955* Cornell U., Ithaca, N.Y.
ROTATION OF THE MAGNETOSPHERE
W. I. Axford Repr. from J. Geophys. Res., v. 68, no. 20, 15 Oct. 1963 p 5883–5885
(NASA Grant NsG-382)

Possible effects due to the noncoincidence of the earth's rotational and magnetic poles on suggested models of the topology of the geomagnetc field are discussed. It is suggested that the supersonic solar wind should produce a standing shock wave on the upstream side of the magnetosphere, and that between the shock wave and the surface of the magnetosphere near the solar-wind stagnation point (0) the solar-wind bulk velocity is quite low, but it accelerates as it passes around the magnetosphere and eventually becomes supersonic again. Assuming that the contribution of the magnetosphere rotation to the relative motion (between the solar wind and the surface of the magnetosphere) in the clockwise direction may be comparable with that of the solar wind, the point of zero relative velocity would then be well to the west of 0. Since several geomagnetic phenomena exhibit a tendency to be symmetrical about a geomagnetic meridian which makes an angle as large as 40° to 50° to the west of the earth–sun line, it is suggested that this effect can be satisfactorily explained as being due to high rotational speeds at the surface of the magnetosphere and thus it is not necessary to assume that the solar wind moves other than radially outward from the sun. P.V.E.

N64-12960* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRICITY IN THE TERRESTRIAL ATMOSPHERE ABOVE THE EXCHANGE LAYER
Elden C. Whipple, Jr. Washington, NASA, Jan. 1964 24 p refs Presented at the Third Intern. Conf. on Atmospheric and Space Elec., Montreux, Switzerland, May 6–10, 1963
(NASA TN D-2092) OTS: $0.75

Some of the reactions involving ions and electrons that might occur between the troposphere and the bottom of the ionospheric D-region (20 to 60 km) are discussed. Electrons are produced by cosmic-ray ionization and by detachment from negative ions, and are lost by attachment to O_2. Photodetachment predominates during the day, but at night only collisional detachment is effective. Ion-ion recombination accounts for the removal of ions, the Thomson three-body process predominating below 45 km and the two-body mutual neutralization reaction above that altitude. Probable ion and electron densities in this region during quiet solar conditions are presented. The mechanism of charge collection by bodies in the atmosphere is discussed with respect to two important applications: the effect of dust in providing a recombination surface for ions, and the problem of interpreting current-voltage curves obtained with ion probes. A perturbation solution of the Boltzmann equation to describe ion collection implies two assumptions, each of which becomes questionable at certain altitudes in this region of the atmosphere. Author

N64-12988 Agricultural Research Service, Riverside, Calif. Salinity Lab.
WATER TRANSFER FROM SOIL TO THE ATMOSPHERE AS RELATED TO SOIL PROPERTIES, PLANT CHARACTERISTICS AND WEATHER Annual Report
W. R. Gardner, D. L. Decker, C. F. Ehlig, P. F. Low et al July 1963 104 p
(DA Cross S vice Order 2-63)

Papers presented include: (1) relation of root distribution to water uptake and availability; (2) relationship between transpiration and the internal water relations of plants; (3) the influence of soil water on transpiration by plants; (4) impedance to water movement in soil and plant; (5) pressure dependence of the relative vapor pressure of water in soil; and (6) a thermocouple psychrometer for measuring the relative vapor pressure of water in liquids or porous materials. J.E.T.

N64-13009* Pennsylvania State U., University Park Ionosphere Research Lab.
FACTORS CONTROLLING THE SHAPE OF THE UPPER F REGION UNDER DAYTIME EQUILIBRIUM CONDITIONS
John S. Nisbet Repr. from J. Geophys. Res., v. 68, no. 22, Nov. 15, 1963 p 6099–6112 refs
NASA Grant NsG-134-61)

Equilibrium solutions for the continuity equation for atomic oxygen ions in the upper *F* region in terms of exponential series are developed which take account of diffusion, of the effects of a nondivergent vertical flux of ionization, attenuation of the solar radiation, and lack of temperature equilibrium between the electrons and ions. Above the maximum these series converge rapidly, and they are well approximated by the first few terms. In this way simple solutions of the continuity equation are developed which allow experimentally observed ion- or electron-density profiles to be related to the production, loss, and transport processes. Modified solutions that include the effect of helium and hydrogen ions on the electron-density profile are developed. The solutions are used to investigate the effects of assuming different neutral atmospheric models on daytime equilibrium profiles. The implications of the solutions to the analysis of experimental profiles are discussed. Author

N64-13058* Iowa State U., Iowa City
HIGH-LATITUDE GEOPHYSICAL STUDIES WITH SATELLITE INJUN III. PART IV: AURORAS AND THEIR EXCITATION
B. J. O'Brien (Rice U.) and H. Taylor [1963] 69 p refs
(NASA Grant NsG-233-62; Contract N9onr93803)
(NASA CR-55159; SUI-63-32) OTS: $6.60 ph, $2.27 mf

The auroral zone, as defined on some fifty latitude surveys of the brightness of the N_2^+ emission at 3914 A, showed an average maximum brightness of about 2 kilorayleighs at an invariant latitude (Λ) around 69° on the magnetic shell $L = 7.8$. Several visible auroras are discussed in detail. It is suggested that the auroras delineated the outer edge of the region of durable trapping of Van Allen electrons, and that the electrons causing the auroras and having an isotropic angular distribution over the upper hemisphere at the satellite altitude were mostly freshly accelerated rather than old electrons of the Van Allen belts with similar energy. In two auroras measured by the satellite near perigee, less than 0.1% of the oxygen 5577 A emission came from altitudes above 250 km. Hence, the flux of electrons of energy ~ 10 ev was no larger than the flux of those with ~ 10 kev. Author

N64-13084 Air Force Cambridge Research Labs., Bedford, Mass.
A SOLUTION TO THE REACTION RATE EQUATIONS IN THE ATMOSPHERE BELOW 150 KILOMETERS
Thomas J. Keneshea Sep. 1963 134 p refs
(Contract DASA-WEB-07.010)
(AFCRL-63-711; AD-424173)

A computer program is presented for developing the numerical solution to this problem. The method of solution of the set of equations uses a fourth-order Runge–Kutta integration with a variable mesh. When a species enters its quasi-equilibrium state, its differential equation is removed from the set and its equilibrium equation is inserted into the simultaneous algebraic set. The algebraic set is solved by the method of successive substitutions. The overall solution is obtained by iteration between the differential and the algebraic sets. The ability of the computer program to develop extensive solutions is demonstrated by several examples taken under different conditions. Author

N64-13087 Joint Publications Research Service, Washington, D.C.
SELECTIONS FROM MERZLOTNYE ISSLEDOVANIYA (PERMAFROST RESEARCH) [MOSCOW] NO. 1, 1963
V. P. Dobrovol'skiy et al 13 Jan. 1964 53 p refs
(JPRS-22701; OTS-64-21266) OTS: $1.50

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3. SPECIFIC ELECTRICAL CONDUCTIVITY OF FROZEN ROCK IN A NATURAL STRUCTURE IN THE REGION OF THE CITY OF SALEKHARD A. A. Ananyan, V. P. Dobrovol'skiy p 30–40 refs

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N64-13271* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE ROLE OF SOIL SCIENCE IN SPACE EXPLORATION
Roy E. Cameron 16 Feb. 1963 20 p refs
(NASA Contract NAS7-100)
(NASA CR-53021; JPL-TR-32-339) OTS: $1.60 ph, $0.80 mf

New frontiers in soil science are currently found in the investigation of soils in harsh, terrestrial and simulated extraterrestrial environments, the development of new methods and probes for soil characterization, and the eventual investigation, characterization, and development of extraterrestrial soil. Current aspects of space science involving soil studies are presented, including a more detailed soil study program involving the microflora of desert soil ecosystems. Basic precepts are given for preparation, investigation, and use of extraterrestrial soil. Author

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-12598 Naval Radiological Defense Lab., San Francisco, Calif.
CORRELATION FUNCTION CALCULATION OF HIGHER ORDER CORRECTIONS TO THE LATTICE THERMAL CONDUCTIVITY
W. C. Schieve and R. J. Hardy 24 Sep. 1963 78 p refs
(USNRDL-TR-675; AD-423763)

Making use of the correlation-function formulation, the thermal conductivity is expressed in a power series in λ. The Hamiltonian is $H = H^\circ + \lambda V'$, where H° is the harmonic part. The lowest order contribution is proportional to λ^{-2}; this has been previously shown to agree with results predicted by the Boltzmann-transport equation. Using the generalized master equations of van Hove and Janner to treat the time dependence, contributions to the thermal conductivity of order λ^{-1} are investigated. The contributions arise from: (1) the new nondiagonal elements in the lowest-order flux operator; (2) the effects of the perturbation on the flux operator; and (3) the higher-order terms in the perturbation treatment of the time dependence. These corrections may be calculated by means of Boltzmann-like equations. Author

N64-12636 Air Force Systems Command, Wright-Patterson AFB, Ohio
A SYSTEM FOR MEASUREMENT OF CRYOGENIC THERMAL CONDUCTIVITY OF SOLIDS TO LIQUID NITROGEN TEMPERATURES (−320°F) Technical Report [May 1962-May 1963]
M. L. Minges, J. M. Meiselman, and J. G. Broadus Oct. 1963 35 p refs
(ASD-TDR-63-756; AD-424168)

The design, construction, and calibration of an apparatus for absolute thermal conductivity measurements at cryogenic temperatures are discussed. The method employed is a variation of the Wilkes Calorimeter utilizing liquid nitrogen as the cryogenic fluid. Calibration with Styrofoam (ρ = 2.0 lbs/ft^3) and TFE Teflon (ρ = 138 lbs/ft^3) over mean temperatures from −280° F to +20° F indicates agreement with published data within 5 percent. Heat leaks in the system varied between 4 and 13 percent. Details of automatic temperature control instrumentation and support equipment design are included. A review of various methods for absolute thermal conductivity determinations at cryogenic temperatures is presented. Author

N64-12675 International Union of Pure and Applied Chemistry, Basle (Switzerland)
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, NUMBER 3, JULY, AUGUST, SEPTEMBER 1963
J. J. Diamond, ed. (Nat'l. Bureau of Standards) [1963] 59 p refs For presentation at conf. on "The Measurement of High Temperature," Inst. of Electrical Eng., London, May 11–13, 1964

Contents include: (1) devices for achieving temperatures above 1500° C; (2) devices for measuring and controlling temperatures above 1500° C; (3) devices for physical measurements at temperatures above 1000° C; (4) properties, at temperatures below 1000° C, of materials which melt above 1500° C; (5) properties, at temperatures above 1000° C, of materials which melt above 1500° C; (6) properties, at temperatures above 1000° C, of materials which melt below 1500° C; (7) phase equilibria; and (8) reactions at temperatures above 1000° C. J.E.T.

N64-12720 Pratt and Whitney Aircraft, Middletown, Conn.
THE ENTHALPY AND HEAT CAPACITY OF URANIUM MONOCARBIDE TO 1200C
L. C. Harrington and G. H. Rowe 8 Jan. 1964 16 p refs
(Contract AT(30-1)-2789)
(PWAC-426; TID-4500) OTS: $0.50

The enthalpy (or heat content) of uranium monocarbide was measured in the range 0° C to 1204° C (32° F to 2200° F) using an ice calorimeter. Determinations were made from five elevated temperatures to 0° C. The accuracy of these measurements is estimated to be ±4%. The heat capacity (or specific heat) was calculated from these data. These measured values for enthalpy and calculated values for heat capacity are compared with values found in the literature. The measurements of the enthalpy of platinum–20% rhodium from 0° C to 1538° C (32° F to 2800° F) are also presented. Author

N64-12828 Garrett Corp., Los Angeles, Calif.
DESIGN AND MANUFACTURING DEVELOPMENT OF LIGHTWEIGHT HEAT EXCHANGERS Interim Technical Progress Report, 1 Jul.-30 Sep. 1963
K. O. Parker, C. M. Lee, D. Mc Grath, W. Brown, and E. L. Powell et al Oct. 1963 82 p
(Contract AF 33(657)-9340)
(ASD-TR-7-936 (V); AD-421593)

Descriptions are given of the work conducted toward the selection of materials and fabrication techniques for lightweight heat exchangers for use in advanced systems. Included are descriptions of the die forming, drilling, reaming, extruding, and trimming operations involved in fabrication of the detail

components of the test module, completion of the first tube bundle of aluminum, and the modification of the weld-joint geometry to improve reliability. C.L.W.

N64-12847 Columbia U., New York, N.Y. School of Engineering and Applied Science
AN EXPERIMENTAL STUDY OF HEAT TRANSFER AT HIGH TEMPERATURE DIFFERENCES IN TURBULENT AIR FLOW BETWEEN A ROTATING CYLINDER AND A STATIONARY CONCENTRIC OUTER CYLINDER Final Supplementary Report
G. S. Longobardo and H. G. Elrod Oct. 1963 16 p
(Contract AF 49(638)-1001)
(AFOSR-3207; AD-425346)

Progress reported includes: (1) Turbulent flow without Taylor-type vortices can be obtained above a Taylor number of about 3000 with the present apparatus. Under some conditions of operation, two types of turbulent flow appear to be possible—one with vortices and the other without them. (2) A better method of selecting the interferogram reference temperature was devised. This method takes advantage of the fact that the temperature varies almost linearly with V_θ/r. Extrapolation is then made directly to the surface temperature without appeal to overall heat-transfer measurements. (3) A method was devised for the correlation of the eddy diffusivity of momentum for vortex-free turbulence. (4) The ratio of the eddy diffusivity of heat to that of momentum remains at 1:4 for air, under circumstances of considerable property variation. I.v.L.

N64-12869 Dynatech Corp., Cambridge, Mass.
AN INSTRUMENT FOR MEASURING THE THERMAL CONDUCTANCE OF HIGH-TEMPERATURE STRUCTURAL MATERIALS
J. K. Sparrell, K. G. Coumou, and J. D. Plunkett Wright-Patterson AFB, Ohio, AF Materials Lab., Sep. 1963 52 p refs
(Contract AF 33(616)-8099)
(ASD-TDR-63-359; AD-421886)

A thermal conductivity apparatus employing the absolute guarded hot plate principle has been designed, developed, and fabricated. The primary objective of this instrument is to test honeycomb structures at elevated temperatures. A secondary objective is to test superalloys, ceramics, and cermets. Operational requirements are as follows: sample temperature—approximately 300° to 3000° F; heat dissipation from main and guard heaters—1000 to 20,000 Btu/hr-ft^2; heat dissipation from auxiliary heaters—0 to 15,000 Btu/hr-ft^2; environments—air, argon, vacuum approximately 10^{-5} mm Hg; sample size—12 in. × 12 in. square, 3/8 in. to 2-1/2 in. thick; accuracy—1800° F within ±5%, 3000° F within ±10%. In general these operational requirements have been met with calibration runs on copper to 1800° F and Al_2O_3 to 3000° F falling within the prescribed accuracy limits. Further thermal conductivity tests have been completed on René 41 honeycomb, titanium alloy honeycomb, L605 cobalt alloy honeycomb, stainless steel, René 41, and fused silica. Author

N64-12906 Argonne National Lab., Ill.
HEAT CAPACITY STUDIES OF URANIUM AND URANIUM-FISSIUM ALLOYS
Howard Savage and Richard D. Seibel (Denver Res. Inst.) Sep. 1963 29 p refs
(Contract W-31-109-eng-38)
(ANL-6702)

The heat contents of high-purity uranium and uranium-fissium alloys containing 3, 5, and 8 w/o fissium were measured at temperatures from 0° C through their fusion temperatures. The total heat content above 0° C was determined by drop calorimetry and quantitative differential thermal analysis. The total heat content from 0° C to 1200° C was found to be 16.1 ±0.3, 16.3 ±0.6, 16.3 ±0.6, and 16.4 ±0.4 kcal per equivalent gram atom, for the 0,3,5, and 8 w/o fissium alloys, respectively. Curves of the heat content vs temperature are plotted for all the alloys and the high-purity uranium. Heats of transition and of fusion were determined. The directly measured value of 2.9 ±0.1 kcal/g-atom for the heat of fusion of uranium is consistent with that of the alloys. Author

N64-12965 Massachusetts Inst. of Tech., Cambridge Engineering Projects Lab.
VISUAL STUDY OF TWO-PHASE ONE-COMPONENT FLOW IN A VERTICAL TUBE WITH HEAT TRANSFER
S. William Gouse, Jr. and Cheng-Chieh Hwang 3 Jun. 1963 55 p refs
(NSF Grant 11355; NSF Grant 19771)
(Rept. 8973-1)

A closed loop, incorporating a transparent resistance heating film coated glass tubing test section, 0.430" ID approximately 13 ft long, was built to permit the visual study of subcooled or saturated two-phase one-component flow in a vertical tube with and without heat transfer under natural and forced circulation conditions. The test fluid was n-pentane. The range of variables was as follows: heat flux 0 to 5500 Btu/hr-ft^2, flow rate 76 to 1300 lbm/hr, inlet subcooling 0° to 41° F. For the range of variables investigated, the major conclusions appear to be: (1) Discrete bubble flow ceases, and a transition flow commences when the bulk of the fluid becomes saturated. (2) An annular flow seems to appear when there is an inflection point in the pressure distribution, or when the pressure drop per unit length stops decreasing and starts increasing. (3) Once the bulk of the fluid became saturated, the major vapor generation appeared to take place by the growth of existing vapor spaces rather than by further nucleation. Author

N64-12977 Rock Island Arsenal, Ill.
ROCK ISLAND ARSENAL HEAT RESISTANT ELASTOMER PROGRAM
1 Nov. 1963 14 p refs
(RIA-63-3591; AD-423192)

Results of projects dealing with research into heat-resistant elastomers are presented. Projects discussed include ones with the following objectives: (1) to synthesize a series of siloxanes containing arylene modification in the backbone; (2) to synthesize a group of polymeric phenyleneperfluoroalkylene siloxanes and evaluate for improved thermal stability; (3) to synthesize regulated structure elastomers consisting of polyphenyl ether and siloxane blocks; (4) to synthesize a series of metallosiloxane elastomers for potential application as insulating materials for rocket engines; (5) to synthesize thermally stable elastomers based on silicocarborane structures; (6) to synthesize a series of polysilcarbane elastomers and evaluate them for thermal stability; (7) to synthesize boron containing elastomers having outstanding high temperature, low temperature, and/or solvent resistance properties; and (8) to synthesize heat-resistant elastomers based on a predominantly silicon–carbon backbone. P.V.E.

N64-12981 Michigan U., Ann Arbor Coll. of Engineering
INVESTIGATION OF LIQUID METAL BOILING HEAT TRANSFER Second Quarterly Progress Report [15 Aug.-15 Nov. 1963]
Robert E. Barry, Herman Merte, Jr., Bruce F. Caswell, Andrew Padilla, Jr., and Lowell R. Smith Nov. 1963 34 p refs
(Contract AF 33(657)-11548)
(AD-423679)

The high flux nucleate pool boiler has been cleaned of potassium and recharged with water in an attempt to obtain burnout data which might be compared with existing data for other geometries. Two burnouts were experienced accidentally, and neither yielded accurate values. Recalibration of thermocouples used in the film boiler has revealed substantial drift. Efforts to stabilize and calibrate the microthermocouples prior to rerunning the potassium are continuing. Additional pressure drop data were obtained prior to draining the loop of potassium and sodium. Author

N64-13236 Massachusetts Inst. of Tech., Cambridge
THE MECHANISM OF VOID FORMATION IN INITIALLY SUBCOOLED SYSTEMS
Peter Griffith and George Snyder Sep. 1963 31 p refs
(Contract Nonr-1841(39))
(Rept. 9041-26; AD-423572)

When an initially subcooled water-filled system undergoes a transient in heat flux or pressure such that bubbles form, the most important variable which determines the volume of the resulting void is the number of bubbles that are formed. The latter are shown to be a function of the surface microconfiguration, the contact angle, and the history. A method of specifying the history is developed, experiments are run, and the general correctness of the history specification is shown to be correct. Order of magnitude values of the limiting wall superheats as a function of the surface history and configuration are presented, but the reproducibility of the experiments is not found to be high. Author

N64-13252* McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF THERMO-LAG FOR MERCURY APPLICATIONS
G. Salisbury 10 Dec. 1963 11 p
(NASA Contract NAS5-59; Contract AF 33(657)-11215)
(A261; AD-425104)

Two materials, Thermo-Lag T-230 and Thermo-Lag T-450, were tested for odor, reaction with 90-percent hydrogen peroxide, combustibility and sublimation temperature at reduced pressure. The sublimation temperatures of T-230 and T-450 at 10 mm pressure were 165° F and 347° F, respectively. The sublimation rate of T-230 was 71% weight loss in 35 minutes and that of T-450 was 8.8% weight loss in 100 minutes. Author

N64-13327 Lockheed Aircraft Corp., Sunnyvale, Calif.
MECHANICS OF HEAT PUMPS AND ABSORPTION REFRIGERATION: AN ANNOTATED BIBLIOGRAPHY, DEC. 1961
Helen M. Abbott, comp. Apr. 1962 34 p refs
(Contract AF 04(647)-791)
(SB-62-16; AD-276467)

This collection of references was selected as an aid to further research on the use of heat pumps for spacecraft applications in systems needing reversed cycles for heating and cooling. The mechanics of heat pumps, absorption refrigeration, thermoelectric and solar refrigeration were investigated. Author

N64-13343 Mound Lab., Miamisburg, Ohio
ANALYSIS OF THE UNSTEADY STATE IN THE THERMAL DIFFUSION CELL
Tokuro Mizushina and Ryusho Ito 23 Oct. 1963 17 p refs
Transl. into ENGLISH of an article from Kagaku Kogaku (Japan) v. 25, no. 1, 1961 p 34-40
(Contract AT-33-1-GEN-53)
(MLM-1167(Tr)) OTS: $0.50

In an investigation of thermal diffusion phenomena, an exact solution is obtained for measuring the coefficient of ordinary diffusion D and the Soret coefficient σ. The solution, in the form of a series of error functions, is obtained by the use of Laplace transforms. It describes the early stages of concentration changes in a cell and enables obtaining D and σ from an experiment of relatively short duration. In this study, the nonlinear terms in the governing differential equations are linearized by expansion in a Taylor series, and the resulting simultaneous partial differential equations are solved by means of Laplace transforms. The solution gives the time dependence of the concentration for the upper and lower cells, respectively C.L.W

N64-13403* Little (Arthur D.) Inc., Cambridge, Mass.
DESIGN OF THERMAL PROTECTION SYSTEMS FOR LIQUID HYDROGEN TANKS
Apr. 1963 79 p refs
(NASA Contracts NAS5-664 and NASw-615)
(NASA CR-55252; C-65008-3-01) OTS: $7.60 ph, $2.57 mf

An account is given of the progress achieved in the design, experimental measurement, and analysis of thermal protection systems for liquid hydrogen tanks in the following areas: (1) environments affecting thermal protection systems; (2) selection of materials for thermal protection systems; (3) thermal conductivity measurements; (4) experimental results—temperature, density, mechanical load, contact resistance, emissivity, and gas pressure; (5) requirements for application of multilayer insulation to liquid hydrogen tanks and (6) spherical, cylindrical, and flat plate thermal conductivity apparatus.
R.T.K.

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-12715* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FIXED-BASE VISUAL-SIMULATOR STUDY OF PILOT CONTROL OF ORBITAL DOCKING OF ATTITUDE-STABILIZED VEHICLES
Donald R. Riley and William T. Suit Jan. 1964 46 p refs
(NASA TN D-2036) OTS: $1.25

A study has been made on a fixed-base simulator of the ability of human pilots to perform the final docking between a manned spacecraft and an orbiting tank by using only visual cues for guidance. The results of the investigation showed that, for most of the simulator flights, the pilots performed the docking maneuver with the following accuracies at contact: (1) vertical and lateral displacements of a coupling mechanism of 1 inch or less; (2) longitudinal contact velocities less than 0.1 fps; (3) residual vertical and lateral velocities of 0.04 fps or less. Flights from 40 feet to contact could be performed in about 3 minutes. The characteristic-velocity increment (an indication of fuel consumption) was small; however, it increased with an increase in control acceleration for the range investigated (0.1 to 1.0 ft/sec^2). Additional considerations of a human's visual capability for judging closing velocity due to size change indicate that a human pilot can serve as a sensor for information gathering with sufficient accuracy for the entire docking maneuver. Author

N64-12752 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin
A STUDY OF VOCATIONAL INTERESTS OF AIRLINE PILOT CANDIDATES
S. Fichtbauer and H. Kirsch *In its* Lectures from the Inst. for Flight-Med. delivered at the XI European Aeron. and Cosmonautical Med. Congr., Sep. 1963 p 11–15 (See N64-12751 04-16)

The selection procedure for becoming a pilot of the Deutsche Lufthansa requires that all young candidates answer a personality questionnaire. Among others, the questionnaire includes some questions regarding the motives for choosing this profession, favorite extracurricular activities, and previous failures. The answers of 100 pilot candidates were correlated with the pilot achievement and motivational professional adjustment which the candidates showed during their subsequent airline pilot training. A low positive correlation was found between the motivational adjustment criterion and the statement that being a pilot is attractive because of the high, versatile requirements of the profession. Furthermore, there was a low positive correlation between the statement that no previous failures were worth mentioning, and the pilot qualification. Finally, and surprisingly, a low negative correlation was seen between technical and mechanical interests and pilot achievement.
Author

N64-12849 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAN AND THE COSMOS
V. V. Parin 16 Jan. 1963 4 p Transl. into ENGLISH of an article from the Russian newspaper, Sov. Litva, 31 Mar. 1961 p 4
(FTD-TT-62-1605/1; AD-295783) OTS: $1.10

Professor Parin predicts the occurrence of man's flight into space. The improvement in Soviet technology and the extensive program of biological investigations that will make the flight possible are discussed.
R.T.K.

N64-12975 Royal Inst. of Tech., Stockholm (Sweden)
SPEECH ANALYSIS TECHNIQUES Quarterly Technical Status Report No. 1, 1 Aug.–31 Oct. 1963
1963 4p
(Contract DA-91-591-EUC-3080)
(AD-424609)

Research activities in the following areas are summarized: (1) spectrograms of Swedish stops—a general study of Swedish and English speech material has started in order to collect a representative set of spectrograms and supplementary acoustic records of a selected set of vowel and consonant allophones; (2) spectrum envelopes for synthetic vowels—a computer program has been written which calculates the harmonic specification of a formant pattern directly from the separate formants and, in addition, compares these calculated harmonics with read-in harmonics which may be obtained either from a natural vowel or a machine synthesized vowel; and (3) a study in French intonation—a study is presented of the role of fundamental frequency as determined by systematic variations in synthetic speech.
P.V.E.

N64-13005 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
FUNCTIONAL DESCRIPTION OF A CONTROLLER/EQUIPMENT MODULE Final Report
A. Bezgin, R. J. Kosich, and R. G. Wolcott Jul. 1963 116 p
(Contract ARDS-612)

A study was conducted to describe and simulate a controller/equipment module; that is, a human controller, a satellite computer, and associated displays and controls. The results, described in this report, show that this modular concept has application in several areas of air traffic control. A simplified simulation model of the module has been developed, and will serve as a test bed for further exploration into air traffic control problems, and also assist in a continued study and definition of a controller/equipment module. The model includes a simulation of the controller, communications, aircraft and pilot response, and the air traffic environment, in addition to the module functions of conflict search, detection and resolution. It also includes the first steps taken in the development of the higher-level functions of adaptive feedback control and automated learning.
Author

N64-13108 Douglas Aircraft Co., Inc., Long Beach, Calif.
DYNAMIC VISION-III. THE LEGIBILITY OF ALPHANUMERIC SYMBOLS-MODERATELY SPACED
D. M. Lee 30 Jul. 1963 102 p refs
(LB-31403; AD-425035)

Targets subtended an angle of 39 min. at the observer's eye, and were spaced from each other at a distance which subtended 7.5° at the observer's eye. The targets were black on white and moved vertically in the frontal place, from top to bottom. Experiments were as follows: (1) Equally spaced alphanumeric symbols randomly ordered in three columns, each column containing 26 symbols, were used as stimulus material. It was shown that no significant increase in performance, measured in angular velocity of the stimulus material, was obtained with serial presentation of the columns. (2) Individual criteria and sample means for 100-percent legibility were determined. (3) The stimulus material was presented both by television and by direct viewing. Performance, based on angular velocity at which 100 percent could be scored, was approximately 30 percent lower for television viewing. (4) Individual criteria and sample means for zero legibility were determined.
Author

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-12611 Air Force Cambridge Research Labs., Bedford, Mass.
ION DISSOCIATION IN THE DRIFT TUBE OF A TIME-OF-FLIGHT MASS SPECTROMETER: II. FIXED Δt METHOD OF IDENTIFYING FRAGMENT IONS
W. W. Hunt, Jr. Oct. 1963 13 p refs
(AFCRL-63-722; AD-424674)

The fixed Δt method of identifying fragment ions formed in the drift tube (analyzer) of a time-of-flight mass spectrometer depends on determining the potential barrier characteristics required to produce a preselected flight-time shift. It is both simpler and more accurate than the comparison method used in a previous series of experiments.
Author

N64-12627 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MICROWAVE WATTMETER
31 Oct. 1963 4 p Transl. into ENGLISH from the German Publ. "Mikrowellen Leistungsmesser" p 1–4
(FTD-TT-63-992/1; AD-424441)

The instrument, TZA-302, measures microwave power of the order of milliwatts. In its design, the instrument follows a new principle in that the power to be generated is converted to heat in a metal–lamina resistor. This heat warms up the air around the resistor. As a result of this heating, an air current is formed in a channel around the resistor, and this current turns a measuring foil suspended in the channel. The degree of turning is measured by a built-in reading device (an autocollimator) in such a way that the deviation, which is read on the scale of the device, represents a linear function of the power. Direct current of an unknown value is fed to the lamina resistor through a connection on the front plate of the device which enables its calibration. The operation of the instrument is extremely simple. There are two buttons on the front plate. One of them serves to set the measuring foil, which is suspended on a torsion filament, at zero. The second button controls an adjustable short circuit which sets the instrument at the optimum value. I.v.L.

N64-12653 Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.
NEW SHEAR APPARATUS FOR TEMPERATURES OF 1000°C AND PRESSURES OF 50 kb
R. E. Riecker and K. E. Seifert Nov. 1963 23 p refs
(AFCRL-63-780; AD-425629; *Its* Instrumentation for Geophys. and Astrophys. 34)

A new shear press, capable of simultaneous pressures and temperatures of 50 kb and 1000°C, incorporates a 5-kw high frequency induction heater, 300-ton hydraulic jack, 1/2-HP motor and 3-pinion gear train for strain rates of 0.01 to 10 rph, and tungsten carbide ball-type anvils faced to diameters of 1/4 in. to 1 in. The press, designed to simulate earth depths of 30 to 200 km, determines shear strength, viscosity, and internal friction data for rock samples of lower crust and upper mantle composition under geophysically realistic conditions of temperature and pressure. Author

N64-12704 Radiation Inc., Melbourne, Fla.
TELEMETRY TRANSDUCER HANDBOOK
H. F. Fisher, Jr. Wright-Patterson AFB, Ohio, AF Flight Dynamics Lab., Sep. 1963 768 p refs
(Contract AF 33(616)-8309)
(WADD-TR-61-67, Vol 1, Rev. 1; AD-421951) OTS: $5.60

The characteristics of the transmission system and its relation to transducers and telemetry systems are discussed in detail. The fundamentals involved in various physical measurements and how these fundamentals are employed in the general design of transducers are covered. Measurements of displacement, strain, pressure, fluid flow, rotary speed, fuel quantity, ac power, acceleration, temperature, shock and vibration, and thrust are discussed. Testing and calibration techniques and facilities available are presented. Also included are a bibliography, glossary of terms, IRIG Telemetry Standards, definitions of many basic physical effects and principles related to transducer design, and detailed data on acceleration, temperature, and thrust measurement fundamentals. Author

N64-12706 Aerospace Corp., El Segundo, Calif.
SENSING PLASTIC STRAIN WAVES WITH FRACTURING WIRES
J. S. Whittier 30 Sep. 1963 62 p ref
(Contract AF 04(695)-269)
(SSD-TDR-63-250; TDR-269(4230-30)-2; AD-424020)

Plastic surface waves on an impact target can cause fracture of wires cemented to its surface; time of fracture is readily recorded electronically. A summary is presented of the progress in determining conditions for selecting wire, adhesive, and method of assembly so that fracture of a wire implies a definite value of substrate strain. Fracturing wire transducers are compared with other devices for measuring large transient strains. Author

N64-12830 Bell Helicopter Co., Fort Worth, Tex.
CONTACT ANALOG SIMULATOR EVALUATIONS: HOVERING AND AIR TAXI MANEUVERS Technical Report
Joseph A. Sgro and D. J. Dougherty Jul. 1963 116 p refs
(Contract Nonr-1670(00))
(D228-421-016; AD-424485)

Analysis of the findings indicates that (1) the configuration of basic grid plane with pathway, and of basic grid plane with pathway plus tar-strips, was most effective for the hovering maneuvers and also for the takeoff, air taxi, and touchdown maneuvers; (2) for the takeoff, hover, and touchdown maneuver, the displays differed with respect to the various responses being recorded. The configuration of the basic grid plane produced the best performance for vertical velocity for the touchdown maneuvers, while the configuration of the basic grid plane plus ground position indicator provided the best information for touchdown position. Author

N64-12858 Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.
SEISMIC MODEL IMPACTER Research Note
Ker C. Thomson and John A. Hill (Associated Designers, Inc.) Nov. 1963 24 p refs
(Instrumentation for Geophys. and Astrophys. No. 27; AFCRL-63-790 AD-424961)

A new type of strobophotoelastic impact source is described in detail, including specifications, design, and operation. This equipment extends the model size available, for photoelastic studies of propagating waves, from models having linear dimensions of an inch or two to models more than a foot square. The seismic model impacter unit supplies a 1/8-inch deflection, within a time of 1 millisec, to the model material. This impact is repeated precisely 30 times per second. Author

N64-12901 Space Technology Labs., Inc., Redondo Beach, Calif.
DEVELOPMENT OF AN APPARATUS FOR FATIGUE TESTING IN VACUUM
R. P. Felgar 10 May 1963 35 p refs
(EM 13-11; Rept. 9990-6419-KU000)

A description is given of the development of a small fatigue apparatus which might be used for simulation of fatigue-in-space tests. The associated design and fabrication of the fatigue specimen are also presented. The applicability of the device was investigated by conducting fatigue tests on 7075-T6 aluminum alloy in a vacuum chamber at pressures from 8.6×10^{-8} to 4×10^{-9} torr. The results of the fatigue tests in vacuum are compared with an identical test in air. C.L.W.

N64-12939 Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE STAGE CONSTANTS OF CASCADE IMPACTORS
T. T. Mercer Oct. 1963 27 p refs
(Contract AT(29-2)-1013)
(LF-12) OTS: $0.50

The particle size distributions which would be found on each stage of a cascade impactor when used to sample an aerosol having a lognormal mass distribution have been calculated. Three impactors, differing with respect to the collection characteristics of the various stages, were assumed. Samples were obtained from hypothetical aerosols having a wide range of distribution parameters. It is shown that for a particular aerosol the particle sizes appear to be lognormally distributed on all stages and that the mass median diameter for a given stage, calculated from the number distribution on that stage, is a good estimate of the true mass median diameter for that stage. The true mass median diameters and true effective cut-off diameters for each stage and for each aerosol have been calculated also. The latter are shown to be superior for interpreting impactor data. Author

N64-12974 Cornell U., Ithaca, N.Y.
A MODEL FOR A DIFFUSIVE MAGNETO-THERMOELECTRIC GENERATOR
A. W. Riddiford (Harvard U.) and J. S. Krumhansl 24 May 1963 44 p refs
(AD-421931)

The energy equation governing a diffusive generator of Cartesian geometry is derived for a z-component of uniform magnetic field only and for currents and driving forces in the x-y plane only. Steady state is assumed. Heat is forced to flow in the y-direction, and current is allowed to flow in the x-direction. By assuming no current in the heat flow direction and no temperature dependence in the current direction, the current is eliminated from the energy equation, which is then the differential equation for the temperature distribution with arbitrary temperature dependence of the coefficients. The exact temperature and current profiles and the efficiency expression are then worked out in analytic form for temperature independent coefficients. The magnetic field dependence of the coefficients is then calculated assuming classical statistics, and a single carrier. Numerical integrations are done only for scattering by ions. Author

N64-13079 Eagle-Picher Co., Miami, Okla. Research Labs.
GALLIUM PHOSPHIDE DEVICES Third Quarterly Technical Report, 14 Jun. 1963-14 Sep. 1963
J. R. Musgrave, ed., Louis E. Stone, Jno. C. Budiselic, J. S. Roderique, and Paul E. Grayson 14 Oct. 1963 47 p refs
(Contract DA-36-039-AMC-00103(E))
(AD-424770)

Improvements in synthesis of GaP from Ga_2O_3 and elemental phosphorus have been made. An increase or scale-up in synthesis has been accomplished. Vapor phase growth studies have been carried out, with some success in transport. Individual crystal size of approximately 5-mm × 5-mm cross section has been achieved. Epitaxial growth of GaAs on GaP, and the obverse, has been accomplished with good results, by open tube and sealed ampoule techniques, using iodine as the transport vehicle. Diode structures of several forms have been made by diffusion from an SiO_2-Zn film, and improved contacting with low contact resistance is reflected in improved forward diode characteristics. Author

N64-13083 Air Force Cambridge Research Labs., Bedford, Mass.
A TIME-OF-FLIGHT MASS SPECTROMETER ADAPTED FOR STUDYING CHARGE TRANSFER, ION DISSOCIATION, AND PHOTOIONIZATION Research Report
W. W. Hunt, Jr., R. E. Huffman, and J. Saari, G. Wassel, and J. F. Betts et al (Bendix Corp.) Sep. 1963 20 p refs
(AFCRL-63-708; *Its* Instrumentation, for Geophys. and Astrophys. No. 31; AD-424087)

A time-of-flight mass spectrometer has been modified so that (1) the drift tube can be used as a reaction/collision chamber for kinetic studies of charge transfer, ion dissociation, and similar processes; and (2) ions can be produced in the source by either pulsed- or continuous-electron or photon beams. Variable potential barriers, produced in the drift tube by means of movable, screened, retarder grid assemblies, permit parent ions and fragment ions to be separated, identified, and measured after reaction times that are selectively variable within the range $7.197 \times 10^{-3}(m/q)^{1/2} \leq t_r \leq 7.053(m/q)^{1/2}$, μsec, where m/q is the mass-to-charge ratio of the parent ions in amu per electron charge. The kinetic energy range is from 100 to 10,000 ev for positive ions, and 3,000 ev for negative ions. The residence time of ions within the ionizing region can be varied continuously from 0 to 100μsec. Author

N64-13162 Joint Publications Research Service, Washington, D.C.
ARTICLES FROM ZASHCHITA OT RADIOAKTIVNYKH OSADKOV (PROTECTION AGAINST RADIOACTIVE FALLOUT)
A. I. Burnazyan, ed. 9 Jan. 1964 19 p Transl. into ENGLISH of appendices 7 and 8 Moscow, Medgiz, 1963 p 172-184
(JPRS-22669; OTS-64-21247) OTS: $0.50

Descriptions are given of 11 radiometers manufactured in the U.S.S.R. The following information is included: ranges of measurement, subranges of measurement, normal working conditions, power supply, dimensions, accuracy of the indicator reading, and weight of the operating assembly. R.T.K.

N64-13167 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
ROUTINE TESTING AND CALIBRATION PROCEDURES FOR MULTICHANNEL PULSE ANALYZERS AND GAMMA-RAY SPECTROMETERS
D. F. Crouch and R. L. Heath Nov. 1963 32 p refs
(Contract AT(10-1)-205)
(IDO-16923) OTS: $0.75

Procedures for the routine calibration of gamma-ray scintillation spectrometers and multichannel pulse-height analyzers are presented. A standard laboratory scintillation spectrometer, designed for the application of recently developed computer data processing techniques, is described in detail. The performance specifications required of all electronic components in this application are discussed. In particular, the performance specifications for multichannel pulse-height analyzers are treated at length, and simple laboratory tests are described which will determine the performance specifications of an analyzer. These tests include live-timer accuracy, zero and ADC stability with count rate, ADC linearity, and long-term system stability. Author

N64-13308 New Mexico U., Alburquerque
THE CALIBRATION AND INTERPRETATION OF RECORDED SHOCK-TUBE PRESSURE DATA USING PIEZOELECTRIC SENSORS
F. J. Janza and C. W. Hicks Kirtland AFB, N. Mex., Weapons Lab., Nov. 1963 82 p refs
(Contract AF 29(601)-6002)
(RTD-TDR-63-3073; AD-425990)

This report is intended to serve as a guide for the calibration and analysis of recorded pressure data. Many of the

techniques and areas covered are also applicable to other types of gages, i.e., strain, velocity, acceleration, etc. Photographs of typical shock-tube data are used to familiarize the reader with the actual appearance of the true pressure pulse which has been modulated by the effects of resonance, overshoot, groundloops, inadequate bandwidth, and poor gage isolation. Author

N64-13357 Aeronautical Research Council (Gt. Brit.)
A COMPRESSOR ROUTINE TEST CODE
N. A. Dimmock London, HMSO, 1963 46 p refs
(ARC-R&M-3337; supersedes NGTE-R-246, ARC-22791) Available from HMSO: 18s 6d

The code aims at defining methods of measurement and weighting whereby compressor performance can be obtained sufficiently accurately for a realistic and direct comparison to be made between one compressor and another. The measurement of a quantity at a point in the fluid flow, and the averaging and weighting of such measurements have been treated separately as far as is possible. Author

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-12432 Joint Publications Research Service, Washington, D.C.
REACTIONS OF THE BODY TO THE EFFECT OF LOW DOSES OF IONIZING RADIATION
M. G. Durmish'yan et al 13 May 1963 84 p refs Transl. into ENGLISH of selected chapters from the book "Reaktsii Organizma na Deystviye Malykh Doz Ioniziruyushchey Radiatsii", Moscow, 1962 p 3–28, 219–247, 251–259, and 302–303
(JPRS-19163; OTS-63-21809) OTS: $2.25

CONTENTS:

1. THE REACTIONS OF THE BODY TO THE EFFECT OF LOW DOSES OF IONIZING RADIATION M. G. Durmish'yan p 4–25 (See N64-12433 04-16)
2. SOME CHARACTERISTICS OF EXCRETION OF RADIOACTIVE SODIUM FROM THE BODIES OF WHITE RATS AND RABBITS V. P. Godin, S. I. Gorshkov, and L. V. Zhidkova p 26–35 refs (See N64-12434 04-16)
3. RATES OF EXCRETION OF Co^{60} AND Cs^{137} FROM THE BODIES OF ANIMALS S. I. Gorshkov, and A. F. Denisov p 26–35 refs (See N64-12435 04-16)
4. EXCRETION OF Br^{82}, Rb^{86} AND I^{131} FROM THE BODIES OF WHITE RATS S. I. Gorshkov, and A. F. Denisov p 43–51 refs (See N64-12436 04-16)
5. THE EFFECT OF FACTORS OF A NONRADIOACTIVE NATURE ON THE RATE OF Na^{24} EXCRETION V. P. Godin p 52–64 refs (See N64-12437 04-16)
6. DETERMINATION OF THE RULES AND REGULATIONS OF EXCRETION OF RADIOACTIVE SUBSTANCES IN THE CALCULATION OF INTERNAL DOSES OF IRRADIATION A. F. Denisov p 65–78 refs (See N64-12438 04-16)

N64-12433 Joint Publications Research Service, Washington, D.C.
THE REACTIONS OF THE BODY TO THE EFFECT OF LOW DOSES OF IONIZING RADIATION
M. G. Durmish'yan *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 4–25 (See N64-12432 04-16) OTS: $2.25

The results of studies on the biological effect of low internal doses of radioactive isotopes, chiefly Na^{24} and P^{32}, on the bodies of rats, rabbits, and dogs are summarized. The following aspects were considered: (1) the comparative radiosensitivities of various organs and systems, including nervous function, conditioned reflexes, endocrine function, sympathetic nervous system, hemopoietic system, blood serum chemistry, excretory function, glomerular filtration, and the summation effects of subliminal doses; (2) the significance of the age factor in determining the degree of radiosensitivity of the body; (3) the cyclic nature of chronic effects of low activity doses of radioisotopes; (4) the combined effects of low doses of irradiation and nonradiative factors; and (5) characteristics of excretion of radioactive sodium from the body. These studies should be useful in determining the initial indications of radiation injuries and in providing substantiating data for establishing permissible radiation levels. M.P.G.

N64-12434 Joint Publications Research Service, Washington, D.C.
SOME CHARACTERISTICS OF EXCRETION OF RADIOACTIVE SODIUM FROM THE BODIES OF WHITE RATS AND RABBITS
V. P. Godin, S. I. Gorshkov, and L. V. Zhidkova *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 26–35 refs (See N64-12432 04-16) OTS: $2.25

The rate of excretion of radioactive sodium from the bodies of rats and rabbits was studied in order to obtain baseline data for accurate calculation of internal irradiation doses. The following conclusions are presented: (1) Na^{24} is completely resorbed from the injection site. (2) Na^{24} is excreted principally in the urine with only trace amounts excreted in the stool. (3) The excretion rate is dependent upon the amount administered. (4) Na^{24} excretion occurs more slowly in rabbits than in rats; this difference is more pronounced after the administration of small doses. (5) Prior saturation of the body with stable sodium leads to a 16.8% to 50.4% acceleration in Na^{24} excretion. After the administration of an 0.05 millicurie dose of Na^{24} following saturation with stable sodium, the effective half-life of Na^{24} was reduced from 82 to 51 hours after the administration of an 0.05 millicurie dose and from 64 to 45 hours after administration of 0.5 millicurie. M.P.G.

N64-12435 Joint Publications Research Service, Washington, D.C.
RATES OF EXCRETION OF Co^{60} AND Cs^{137} FROM THE BODIES OF ANIMALS
S. I. Gorshkov and A. F. Denisov *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 36–42 refs (See N64-12432 04-16) OTS: $2.25

Co^{60} and Cs^{137} were administered subcutaneously in rats in 100, 50, and 10 millicurie doses, and the gamma radioactivity of the rats was compared to the radioactivity of water phantoms with the same initial activities of Co^{60} and Cs^{137}. The results indicate that this method gives results comparable with the usual method of determining the excretion rate according to the radioactivity of the excreta. Other conclusions are: (1) The tissue absorption of Co^{60} is 27% and of Cs^{137}, 100%. (2) The time at which 50% of the administered radioisotope is excreted is inversely proportional to the quantity administered. (3) Every successive 50% of the remainder is excreted more slowly, which is not in agreement with the generally accepted concepts of the constancy of effective

half-life and exponential excretion rates; (4) Two months after administration, an average of 4% of the Co^{60} had not been excreted, and 6% to 10% of the Cs^{137} had not been excreted. M.P.G.

N64-12436 Joint Publications Research Service, Washington, D.C.
EXCRETION OF Br^{82}, Rb^{86}, AND I^{131} FROM THE BODIES OF WHITE RATS
S. I. Gorshkov and A. F. Denisov *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 43–51 refs (See N64-12432 04-16) OTS: $2.25

Bromine^{82}, rubidium^{86}, and iodine^{131} were injected subcutaneously into rats in quantities from 1 to 100 millicuries. The excretion rate of the radioisotopes was determined by comparing the external gamma radiation of the animal to that of a water phantom with the same initial activity. Since the excretion rate was found not to follow an exponential law and the fraction of isotope excreted with time did not remain constant, the data were analyzed in terms of "half-excretion time" θ_B, and "dimunition time" θ_{el}, (where dimunition includes the simultaneous processes of decay and excretion). The tabulated data on each isotope show that the excretion of all three occurs more rapidly with increasing quantity administered. M.P.G.

N64-12437 Joint Publications Research Service, Washington, D.C.
THE EFFECT OF FACTORS OF A NONRADIOACTIVE NATURE ON THE RATE OF Na^{24} EXCRETION
V. P. Godin *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 52–64 refs (See N64-12432 04-16) OTS: $2.25

In an attempt to determine the effect of the functional state of the nervous system on the rate of Na^{24} excretion in rats, solutions of NaCl and caffeine were administered 3 hours prior to the administration of 1.0, 0.5, 0.1, and 0.05 millicuries of Na^{24}. The results indicate that the administration of one cc of a saturated saline solution accelerates the excretion of Na^{24} by 10% to 15% and correspondingly reduces the effective half-life by 20 to 25 hours. The administration of 0.008 gm of caffeine per kilogram of rat was found to accelerate the excretion of Na^{24} by 6% to 8%, thus reducing the effective half-life by 9 to 22 hours. M.P.G.

N64-12438 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF THE RULES AND REGULATIONS OF EXCRETION OF RADIOACTIVE SUBSTANCES IN THE CALCULATION OF INTERNAL DOSES OF IRRADIATION
A. F. Denisov *In its* Reactions of the Body to the Effect of Low Doses of Ionizing Radiation 13 May 1963 p 65–78 refs (See N64-12432 04-16) OTS: $2.25

A method using graph templates of typical curves is proposed for determining internal doses of radioactivity from excretion data. This method was developed because calculations of the doses under the assumption that excretion is subject to an exponential law was found to lead to considerable errors. The graphic method of integration consists of plotting curves showing the decrease in the radioactive substance in a rectangular system of coordinates, cutting out the curves, and determining the area by weighing the paper. The data obtained in this way were tabulated, and standard templates of typical curves were prepared which can be used instead of the analytic weighing technique, thus facilitating the determination of the internal radiation dose without appreciably affecting the reliability of the results. M.P.G.

N64-12442 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON NUTRITION
16 Dec. 1963 30 p refs Transl. into ENGLISH from Vopr. Pitaniya (Moscow), v. 22, no. 6, Nov.–Dec. 1963
(JPRS-22295; OTS-64-21025) OTS: $0.75

CONTENTS:

1. THE USE OF UNICELLULAR ALGAE FOR HUMAN NUTRITION (LITERATURE SURVEY) N. N. Boyko, N. S. Klyushkina, and Yu. I. Kondrat'yev p 1–10 refs (See N64-12443 04-16)

2. CALCIUM AND PHOSPHORUS DIETARY SUPPLEMENT AS A MEANS OF REDUCING STRONTIUM-90 ACCUMULATION IN SKELETAL BONES V. A. Knizhnikov and P. F. Burgryshev p 11–22 refs (See N64-12444 04-16)

3. STRONTIUM CONTENT IN FOOD PRODUCTS OF TURKMEN SSR ACCORDING TO SPECTRUM ANALYSIS DATA N. N. Grigor'yants (Turkmen Med. Inst.) p 23–27 refs

N64-12443 Joint Publications Research Service, Washington, D.C.
THE USE OF UNICELLULAR ALGAE FOR HUMAN NUTRITION (LITERATURE SURVEY)
N. N. Boyko, N. S. Klyushkina, and Yu. I. Kondrat'yev *In its* Transl. on Nutrition 16 Dec. 1963 p 1–10 refs (See N64-12442 04-16)

Investigations cited in this survey indicate that the unicellular algae, *Chlorella* and *Senedesmus*, are suitable as a supplement to human nutrition in a quantity of 30 to 40 grams per day. Furthermore, on the basis of the findings of Powell et al (1961), it may be assumed that man will tolerate well a diet containing up to 100 grams of dry algae daily, at least for a short time. Powell et al note that with algae nutrition, the gastrointestinal symptoms were more pronounced during the first days following consumption. This indicates a rather good adaptability of man to a diet to which unicellular algae are added. According to Japanese scientists, senedesmus protein is somewhat less digestible than chlorella protein, and bleached chlorella protein is better assimilated in the human organism than unbleached chlorella protein. I.v.L.

N64-12444 Joint Publications Research Service, Washington, D.C.
CALCIUM AND PHOSPHORUS DIETARY SUPPLEMENT AS A MEANS OF REDUCING STRONTIUM-90 ACCUMULATION IN SKELETAL BONES
V. A. Knizhnikov and P. F. Burgryshev *In its* Transl. on Nutrition 16 Dec. 1963 p 11–22 refs (See N64-12442 04-16)

A calcium and phosphorus dietary supplement for the reduction of strontium-90 accumulation in the skeletal bones of rats was investigated. Results indicate: (1) There was 33.33% to 50% reduction in the deposit in bone tissue of the strontium-90 entering the gastrointestinal tract when a calcium supplement was added to a diet of either low or normal calcium content. (2) The protective effect of a calcium supplement in the diet is governed primarily by the processes, in the gastrointestinal tract, of "dilution" and "carrying away" of strontium-90 together with the excess unassimilated calcium. (3) The greater the calcium content in the diet, the lower its assimilation and the lesser the "preference" given it over strontium. (4) The highest relative protective effect was observed when the calcium supplement did not exceed the normal calcium content in the diet by more than two to four times. (5) The protective action of the calcium content was enhanced when phosphorus was added to the diet in quantities producing a phosphorus-calcium ratio not exceeding 1:1. (6) A calcium supplement in the diet not

only reduced calcium-45 deposit but also increased excretion of this isotope from the skeletal bones, and apparently of strontium-90 as well. I.v.L.

N64-12497 Joint Publications Research Service, Washington, D.C.

ELECTRON MICROSCOPIC EXAMINATION OF CARTILAGE CELL DIFFERENTIATION IN A REGENERATING BONE

L. N. Mikhaylova *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 19–24 refs (See N64-12493 04-01) OTS: $1.00

The first stage in the regeneration of bone tissue—the development of a cartilage "model" at the site of the removed bone, i.e., the development of the osteogenic cell from a young chrondroblast to a chondrocyte—was investigated. The investigation consisted of an electron microscopic examination of regenerating tibia of white male rats after subperiosteal resection of the diaphysis of the tibia. Results indicate: (1) The process of chrondroblast differentiation, conjugated with the development of the basic cartilaginous matter, includes profound changes in the ultramicrostructure of the cell, which reveals the role of its organoids in the synthesis of protein products which make up to basic matter of cartilage. (2) The granular character of chromatin accumulations indicates the presence of RNA which apparently interacts with the RNA of the cytoplasm. (3) Profound changes are observed in the system of the ergastoplasm and the Golgi apparatus, the cisternae of which apparently accumulate protein products to be eliminated from the cell. (4) The method of formation of fibrillar structures is very complex and apparently does not fit into the alternative: extra or intracellular synthesis. I.v.L.

N64-12498 Joint Publications Research Service, Washington, D.C.

LUMINESCENT ANALYSIS OF LACUSTRINE DETRITUS

A. G. Rodina *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 25–30 refs (See N64-12493 04-01) OTS: $1.00

A luminescent analysis of *Lacustrine detritus* was conducted in incident light with the opaque illuminator of the Blumberg system with an SVDSh-250-3 lamp with T-2N and SS-4 light filters. The following fluorochromes were used: coryphosphine and acridine orange. Both fluorochromes were well absorbed by the bacteria of the detritus and produced bright contrast luminescence in them. It was revealed that the detritus in these lakes is heterogeneous in composition and that it is autochthonous, planktonogenic, and chiefly algogenic. In addition this analysis revealed: (1) Bacteria are not only present on the surface of the detritus particles and around them, but also penetrate within them, frequently filling the entire contents as their inherent components. (2) The bacteria that develop in detritus are relatively large in size, and fine cells are practically absent. (3) Bacteria surround still, living algae. (4) Rapid thinning of animal tissues occurs under the influence of bacteria and their enzymes. (5) The food value of detritus is determined not only by the organic remains, but also by the enormous quantity of bacteria that develop on it and whose food value for aquatic animals is unquestioned. I.v.L.

N64-12499 Joint Publications Research Service, Washington, D.C.

THE MECHANISM OF THE BIOLOGICAL ACTION OF A PULSED MAGNETIC FIELD

N. A. Solov'yev *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 31–35 (See N64-12493 04-01) OTS: $1.00

The mechanism of the biological action of a pulsed magnetic field was investigated by the use of a pulsed magnetic field with an exponential increase, and the elimination of the influence of circuit-breaking extractors. Results indicate: (1) No significance of induced EMF and currents was detected in the appearance of phosphene under the action of a pulsed magnetic field of the order of the threshold values; hence the magnetic field itself is biologically active. (2) The increase in the brightness of phosphene (or the corresponding decrease in its threshold amplitude), when the pulse duration of the magnetic field is increased in the region of 15 to 40 msec and the magnetic field intensity is practically unchanged, is evidence of the comparatively slow processes, occurring in the media, which are sensitive to the magnetic field. At the same time, the rate of these processes depends on the magnetic-field intensity, since as the intensity is increased, the threshold duration drops. I.v.L.

N64-12504 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM VOPROSY PSIKHOLOGII (PROBLEMS IN PSYCHOLOGY) [MOSCOW] NO. 1, 1963

A. A. Genkin et al 10 Jun. 1963 6 p refs Transl. into ENGLISH of 2 Articles p 104–109 and 111–113 (JPRS-19615; OTS-63-22013) OTS: $0.75

CONTENTS:

1. SOME PRINCIPLES OF CORRECTION TABLES TO BE USED FOR EVALUATION OF THE RATE OF INFORMATION PROCESSING A. A. Genkin, V. I. Medvedev, and M. P. Shek p 1–16 refs (See N64-12505 04-16)

2. DECREASE IN THE VISUAL FACULTY UNDER CERTAIN CONDITIONS OF FATIGUE M. P. Shek p 17–20 (See N64-12506 04-16)

N64-12505 Joint Publications Research Service, Washington, D.C.

SOME PRINCIPLES OF CORRECTION TABLES TO BE USED FOR EVALUATION OF THE RATE OF INFORMATION PROCESSING

A. A. Genkin, V. I. Medvedev, and M. P. Shek *In its* Transl. from Vopr. Psikhologii [Moscow] no. 1, 1963 10 Jun. 1963 p 1–16 refs (See N64-12504 04-16) OTS: $0.75

Several objections are made to correction tables which use letters of the alphabet as the visual signals in quantitative examination of attention, discrimination, perception, etc. A table is proposed which overcomes most of these objections, since it is made up of signals with an identical *a priori* probability, random distribution, and homogeneity of the perceptive process. This table consists of 660 rings, each with a break in its circumference in one of eight possible positions. Further, the table can be used in four different orientations so that 24 variants of the sequence, all with the same statistical structure, are available. Statistical methods for analyzing the data obtained using this correction table are discussed. M.P.G.

N64-12506 Joint Publications Research Service, Washington, D.C.

DECREASE IN THE VISUAL FACULTY UNDER CERTAIN CONDITIONS OF FATIGUE

M. P. Shek *In its* Transl. from Vopr. Psikhologii [Moscow] no. 1, 1963 10 Jun. 1963 p 17–20 (See N64-12504 04-16) OTS: $0.75

The effect of auditory fatigue on the visual capability of human subjects was determined, using correction charts consisting of rings with breaks in their circumference. Preliminary studies indicated that general fatigue, induced by

comparatively light laboratory work, leads to an increase in auditory and visual capabilities toward the end of a working day as compared to morning data. Isolated fatigue of the auditory and, especially, the visual faculty against a background of ordinary laboratory work, however, was accompanied by a marked decrease in visual perception at the end of a working day. A loss of sensory capability was also noted in subjects placed for a long time in an area having reduced air circulation. M.P.G.

N64-12508 Joint Publications Research Service, Washington, D.C.

CYBERNETICS AND PROGRESS IN SCIENCE AND TECHNOLOGY

A. I. Berg *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 7–24 (See N64-12507 04-01) OTS: $5.00

Despite advances in computer technology in the last 15 years, caution should be used in drawing conclusions when comparing the possibilities of modern electronic automation with the human brain. The basic concept of cybernetics, along with that of information, is optimization. Cybernetics is the science of purposeful and optimal control of complicated systems. This means that this science can help in solving the most difficult problems that are encountered in the next few decades. It will also be of assistance to the sciences concerning living nature, in the collection of full-valued information and in subordinating the forces of nature to the interests of mankind. P.V.E.

N64-12509 Joint Publications Research Service, Washington, D.C.

THE APPLICATION OF CYBERNETICS TO BIOLOGY AND MEDICINE

V. V. Parin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 25–39 (See N64-12507 04-01) OTS: $5.00

The practical side of the problems of cybernetics in biology and in medicine is discussed. Cybernetics is one of the precise physicomathematical sciences and utilizes methods of mathematical and physical simulation for describing any systems, both biological and technological. Cybernetics extends the postulates of automatic control theory to living organisms. The chief peculiarity of biological systems is their multitude of circuits. The very same objects are controlled by several control devices, and these controlling devices are in turn the objects of control. It is stated that the study of biological analyzer systems is the most important practical problem of modern physiology, particularly if it is borne in mind that the receptor apparatuses do not possess constant sensitivity but vary it within quite wide limits, in particular, under the influence of actions sent out from the central nervous system. As a result, extensive research on analyzers, especially with the application of electrophysiological methods becomes of the greatest importance. P.V.E.

N64-12510 Joint Publications Research Service, Washington, D.C.

SELF-REGULATION OF CELLULAR PROCESSES

G. M. Frank *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 40–55 (See N64-12507 04-01) OTS: $5.00

Self-regulation of cellular processes with respect to a cell as a whole is discussed. In considering the internal organization of a cell it is often assumed that in addition to the already well-known catalytic functions of the membrane and multimembrane systems, this organization is an instrument for controlled transfers of substances. Movements in this system cannot be only passive, which would be to assume that two interacting mechanisms exist here: (1) unique enzymes for transfer of substances which are linked with the catalytic function of membranes by their appearance and by "selection" of temporary links; and (2) purely mechanical mechanisms or, more accurately, hydrodynamic capillary effects due to creation of pressure gradients and pumping functions of individual structural elements. The complexity of a living cell is connected not only with a large set of different individual chemical substances with their spatial submicroscopic organization which has been discovered in recent years, but also in the first instance with the complexity of combinations of rapidly completed exchange processes. P.V.E.

N64-12511 Joint Publications Research Service, Washington, D.C.

THE NUCLEIC ACIDS AND THE PROBLEM OF BIOSYNTHESIS OF PROTEIN

A. S. Spirin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 56–63 (See N64-12507 04-01) OTS: $5.00

Three areas of development connected with the problem of biosynthesis of protein and with the problem of the biological role of nucleic acids are discussed: (1) deciphering the method for writing the structure or the genetic information in living cells and the deciphering of the "nuceotide-amino acid" code; (2) investigations into the understanding of the mechanisms for protein synthesis and its regulation resulting in the discovery of certain concrete molecular mechanisms for transfer of this genetic information encoded in nucleic acids to the places for protein synthesis and, in particular, in the discovery of the "messenger" RNA and its role; and (3) discovery of certain regulatory mechanisms in protein synthesis which control the process of transferring information from DNA. P.V.E.

N64-12512 Joint Publications Research Service, Washington, D.C.

WAYS FOR DEVELOPING PHYSIOLOGY AND PROBLEMS OF CYBERNETICS CONNECTED WITH THEM

N. A. Bernshteyn *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 64–79 (See N64-12507 04-01) OTS: $5.00

The important and fundamental advances which physiology (and perhaps, the entire set of biological sciences) is undergoing are discussed, and the points of contact and intersection theoretical cybernetics has with the most urgent problems of modern physiology are elucidated. P.V.E.

N64-12513 Joint Publications Research Service, Washington, D.C.

ON TACTICS USED IN CONTROLLING COMPLICATED SYSTEMS IN CONNECTION WITH PHYSIOLOGY

I. M. Gel'fand, V. S. Gurfinkel', and M. L. Tsetlin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 80–89 (See N64-12507 04-01) OTS: $5.00

Some mathematical models which have been put forth in connection with physiology are examined. P.V.E.

N64-12514 Joint Publications Research Service, Washington, D.C.

THE THEORY OF FUNCTIONAL SYSTEMS AS A PREREQUISITE TO THE DEVELOPMENT OF PHYSIOLOGICAL CYBERNETICS

P. K. Anokhin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 90–113 (See N64-12507 04-01) OTS: $5.00

The development of physiological cybernetics is discussed in the following areas: (1) a functional system as a self-regulating apparatus, (2) afferent synthesis, and (3) the apparatus of the acceptor of an action. A conclusion of the investigation

of the laws for the formation of functional systems on different levels of organization is that there is one universal architectural principle in the activities of an organism. From the standpoint of a cybernetic approach to the problem of life, it is concluded that no attempt to understand the general architecture of adaptations, and of simulation of any manifestations of life, can be considered sufficient if they fail to take into account, in the proper manner, the principles of the organization of functional systems of the organism—afferent synthesis, the acceptor of an action, the formation of an action, and reverse afferentation of its results. P.V.E.

N64-12515 Joint Publications Research Service, Washington, D.C.

AN EXPERIMENT IN THE USE OF MATHEMATICAL MODELLING IN THE STUDY OF THE INTERRELATION OF THE PROCESSES OF STIMULATION AND INHIBITION

G. V. Savinov, L. V. Krushinskiy, D. A. Pless, and R. A. Valershteyn *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 114–128 (See N64-12507 04-01) OTS: $5.00

An investigation into the use of mathematical modeling for testing the laws experimentally established in the study of certain defensive systems used by the nervous system when it is acted upon by strong exterocentric stimuli is discussed. It is concluded that the value of using mathematical models in solving certain physiological problems has been shown. It is shown that proposed interrelationships between the components studied and physiological processes can be tested mathematically. The quantitative parameters of the described process were not accurately determined in the phenomenon under study; however, the model which was constructed showed that the manifold process of the appearance of parabiotic stages can be reduced to the interaction of two relatively simple processes of excitation and inhibition that change in accordance with certain characteristics when the nervous system is acted upon by exterocentral stimuli. P.V.E.

N64-12516 Joint Publications Research Service, Washington, D.C.

THE APPLICATION OF MATHEMATICAL METHODS IN PROCESSING THE RESULTS OF BIOLOGICAL OBSERVATIONS

B. V. Gnedenko, S. V. Fomin, and Ya. I. Khurgin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 129–138 (See N64-12507 04-01) OTS: $5.00

The following areas are discussed with respect to mathematical processing of experimental biological data: (1) the objectives and methods of mathematical processing of experimental data and planning experiments; (2) methods for mathematical processing biological experiments—the application of random processes; (3) separation of the response to stimulation against a background of spontaneous activity; and (4) the spectral characteristics of a tremor. P.V.E.

N64-12517 Joint Publications Research Service, Washington, D.C.

THE APPLICATION OF ELECTRONIC COMPUTER TECHNIQUES TO THE ANALYSIS OF BIOELECTRIC PROCESSES IN THE BRAIN

M. N. Livanov *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 139–153 (See N64-12507 04-01) OTS: $5.00

An investigation of the correlation of points in the brain cortex in order to detect synchronicity is discussed. The investigation indicated that synchronicity did not require a compact arrangement of the correlation points, but that synchronously working points can be separated from each other by areas of the brain cortex that do not participate in the synchronous activity. It is also indicated that insulated constellations of synchronicity are interlaid (e.g., some points in the cortex work simultaneously with one synchronized system and with another). In response to different stimuli, constellations can change in three ways: (1) The synchronized system does not disappear but is reinforced—the amplitudes of the biopotentials participating at its points are increased. (2) The constellation is completely dissolved and can be replaced by another new constellation. (3) The constellation changes without being completely dissolved and retains a part of its previous features. P.V.E.

N64-12518 Joint Publications Research Service, Washington, D.C.

NEW DEVELOPMENTS IN OBTAINING AND ANALYZING INFORMATION ABOUT PHYSIOLOGICAL FUNCTIONS OF THE ENTIRE ORGANISM

Ye. B. Babskiy *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 154–173 (See N64-12507 04-01) OTS: $5.00

A discussion is presented of the problem of what the use of modern technology can do for the study of the physiological processes occurring in the entire organism and what the requirements of the methodologies and equipment to be used for such research are. P.V.E.

N64-12519 Joint Publications Research Service, Washington, D.C.

INFORMATION PROCESSING BY THE BRAIN

A. V. Napalkov *In its* Biol. Aspects of Cybernetics 11 Jun 1963 p 174–191 (See N64-12507 04-01) OTS: $5.00

A study of the principles of information processing, which have arisen during the evolutionary process and are used by the human brain in order to study the problem of optimal organization of an active search system, is discussed. When studying the problem of self-organizing control systems the idea that the basis of complex brain operations is a hierarchical system of programs of operation of various levels is also important. Each of the programs of a higher level shapes and corrects the program of the lower level: the program of the first (lower) level is the program of animal behavior—the conditioned response system; the program of the second level is the program of the self-organizing systems which assures the formation of new forms of behavior under various new conditions; and the program of the third level shapes the program of the second level. The present study of the human brain approached a solution of two basic problems that are being advanced by modern cybernetics: to clarify the algorithms of information processing at the base of the complex operations of the brain and to make clear the structure of the network of nerves that are the basis of these algorithms. P.V.E.

N64-12520 Joint Publications Research Service, Washington, D.C.

PROBLEMS AND DIFFICULTIES IN THE STUDY OF BIOLOGICAL ANALYZER SYSTEMS

G. V. Gershuni *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 192–207 (See N64-12507 04-01) OTS: $5.00

This article is concerned with the study of biological instruments with which an organism perceives the external world. It is theoretically and practically evident that the development of knowledge of the working of the brain and sense organs (the higher creations of nature) cannot be satisfactory with the isolated efforts of any one science. The minimum amount of knowledge necessary for research intended to solve such cardinal problems as the transmission and processing of information in the sense organs requires: (1) detailed knowledge of

the basic structural elements; (2) use of the knowledge accumulated by physiology in its different sectors (electrophysiology, behavorial physiology, psychophysiology, and psychophysics); (3) the logics of the operations which a complex system can perform to solve certain problems; and (4) execution of these tasks in electronic models. It is concluded then that the study of the brain and sense organs as a whole requires the use of methods and concepts of various sciences. P.V.E.

N64-12521 Joint Publications Research Service, Washington, D.C.
CODING INFORMATION ABOUT COLOR IN THE RETINA
N. D. Nyuberg *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 208–213 (See N64-12507 04-01) OTS: $5.00

An analysis of the color coding in the human eye indicates that signals do not proceed as a result of light but as a result of a change in light, that is, they depend on both radiations in sequence. The mechanism by which the eye can determine between continuously changing colors can be conceived as follows: the condition of the receptors changes continuously with three degrees of freedom following changes in the light. A signal is sent when the rate of change reaches a certain level. The signal corresponds to the condition of the receptor at this moment and takes up a certain amount of time in which a new signal cannot be sent. When the signal is over a new signal can be sent which is preceded by erasure of traces of the preceding signal (pre-excitation retardation). As a result, the continuous change in color is transmitted by a discrete sequence of signals with a frequency on the order of the frequency of the merging of the flashes. Such an intermittent transmission of continuous changes of color can provide steady transmission of information about color along one fiber. P.V.E.

N64-12522 Joint Publications Research Service, Washington, D.C.
ELECTROPHYSIOLOGICAL STUDY OF RETINAL FUNCTIONS
A. L. Byzov *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 214–224 (See N64-12507 04-01) OTS: $5.00

Electrophysiological research into the structure of the retina is discussed. The characteristics of the elements of the retina are: (1) the photoreceptors—in the outer segments of the photoreceptors are visual pigments (rhodopsin, iodopsin, and others) which determine the spectral sensitivity of the receivers; (2) the horizontal cells whose dendrites branch in the outer synaptic layer and make contact with the receptors and probably with the bipolars; the electrical reaction of the horizontal cells is hyperbolization lasting for the entire period of illumination; (3) the bipolars, one of whose dendrites makes contact with the receptors (and possibly with the horizontal cells) and a signal, are sent through the other one to the ganglion cells—beginning with the bipolars and above, almost all the elements react only to a change in the intensity of light; and (4) the ganglion cells—receiving signals from the bipolars and probably from the amacrine cells, the ganglion cells are at the output of the retina and send signals to the central nervous system. P.V.E.

N64-12523 Joint Publications Research Service, Washington, D.C.
ON THE IDENTIFICATION OF OBJECTS IN THE VISUAL SYSTEM
V. D. Glezer, A. A. Nevskaya, A. V. Spredinskiy, and I. I. Tsukkerman *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 225–241 (See N64-12507 04-01) OTS: $5.00

From investigations into the primary processing of information in the retina, it is concluded that there is some basis to believe that optimal encoding (encoding with large blocks) occurs in the visual system. The more features that are used to encode the image the less probability there is of an error and the fewer the number of cells (or groups of cells) that are required for the most economical writing of the image. P.V.E.

N64-12524 Joint Publications Research Service, Washington, D.C.
EXPERIMENTS ON TEACHING MACHINES TO RECOGNIZE VISUAL IMAGES
M. A. Ayzerman *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 242–260 (See N64-12507 04-01) OTS: $5.00

A discussion and summary are presented of a project designed to gain greater understanding of the mechanism of teaching and recognition of visual images and to develop the simplest possible methods of reproducing the teaching process on universal computers. The main emphasis thus far has been in the development of methods of artificial reproduction of the mechanism of teaching the recognition of visual images on machines. P.V.E.

N64-12525 Joint Publications Research Service, Washington, D.C.
MODELING THE PROCESS OF INSTRUCTING FOR RECOGNITION ON A UNIVERSAL COMPUTER
M. M. Bongard *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 261–272 (See N64-12507 04-01) OTS: $5.00

A discussion is presented of the methodology, difficulties, and prospects that were uncovered in research into modeling the process of instructing for recognition on a universal computer. The resemblance between the problems of recognition of models and of the complexity of modeling real animal behavior is discussed. P.V.E.

N64-12526 Joint Publications Research Service, Washington, D.C.
TEACHING STOCHASTIC MACHINES
V. I. Varshavskiy, I. P. Vorontsova, M. L. Tsetlin *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 273–283 (See N64-12507 04-01) OTS: $5.00

A description is presented of some very simple models associated with the study of behavior. Some mathematical models are examined, and what can be said in connection with models of the behavior of living things is considered. P.V.E.

N64-12527 Joint Publications Research Service, Washington, D.C.
HUMAN SOLUTION OF THE PROBLEM OF SELECTION WITH PROBABILITY REINFORCEMENT OF THE MOTOR RESPONSES
M. A. Alekseyev, M. S. Zalkind, and V. M. Kushnarev *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 284–303 refs (See N64-12507 04-01) OTS: $5.00

An investigation to determine the characteristics of human solution of the problem of "choosing" one of two actions whose probability of reinforcement varies and to compare this solution with the solution of a similar problem by an automatic machine with a finite number of states is discussed. From the results of the investigation it is concluded that a problem of choice, the reinforcement of motions being anticipated, can be solved by man quite satisfactorily (but somewhat in an inferior fashion when compared to a machine with a linear tactic) and the more so the more complex the problem.

The actual tactics or more accurately, the tactics of solving such problems are very complex and basically are manifest in two variants. Trying to gain the greatest number of reinforcements, the examinees shift from one button to the other either after failing to gain the reinforcement or, conversely, after gaining reinforcement. P.V.E.

N64-12528 Joint Publications Research Service, Washington, D.C.

SOME MECHANISMS OF BIOCHEMICAL SELF-REGULATION AT THE CELL LEVEL

K. A. Kafiani *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 304–312 (See N64-12507 04-01) OTS: $5.00

Certain aspects of the dynamic organization which sheds some light on the mechanism of self-regulation of metabolism on the cell level are discussed. Many enzymatic reactions are inhibited by the products of the reactions, not because of a simple shift in equilibrium, but because of a specific inhibition of the enzyme activity by the direct product of its activity. This "product" inhibition is exhibited in many enzymes which initiate practically irreversible reactions and is a simple negative feedback. In summary it is stated that the end product of an enzymatic reaction can regulate its own formation and that its concentration is a tangible signal which is fed back to the system which forms this product. The self-regulation of the formation of a given product can have the following mechanisms: "product" inhibition of the nearest enzyme of the chain; retroinhibition of the first enzyme in the chain; repression of the entire chain of enzymes. P.V.E.

N64-12529 Joint Publications Research Service, Washington, D.C.

EXPERIENCE IN DETERMINING ORGANISM AUTOMATISM AND ITS USE

V. G. Nesterov *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 313–322 (See N64-12507 04-01) OTS: $5.00

Research into the automatism of plants as compared to the self-regulation of internal processes in animals and into the automatism of complexes of organisms is discussed. One communication circuit between organisms and the environment (the moisture of the former and the state of the latter) is discussed in particular. P.V.E.

N64-12530 Joint Publications Research Service, Washington, D.C.

AN AUTOMATIC OPTIMUM FREQUENCY STIMULATOR AS AN INITIAL GENERAL-PHYSIOLOGICAL MODEL FOR DEVELOPING AUTOMATIC BIOLOGICALLY CONTROLLED TREATMENT-DIAGNOSTIC EQUIPMENT

K. D. Gruzdev and M. P. Spichenkov *In its* Biol. Aspects of Cybernetics 11 Jun. 1963 p 323–326 (See N64-12507 04-01) OTS: $5.00

The stimulator is the first step in the realization of an idea that can be defined generally as follows: the maximum individuality of a treatment dictated by the unremitting demand of its biological and consequently its therapeutic adequacy, which means its practical effectiveness, can be attained using special cybernetic treatment-diagnosis equipment. The machines must be able to give each of the patients subjected to it the possibility of selecting automatically at each moment the form of treatment most suitable for the patient. The stimulator was built to generalize and verify the hypothesis from general-physiological positions. P.V.E.

N64-12570 Joint Publications Research Service, Washington, D.C.

STUDIES IN BIOCHEMISTRY

N. I. Yelkina et al 2 Jul. 1963 25 p refs Transl. into ENGLISH of three articles from Vopr. Med. Khim. (Moscow), v. 9, no. 2, 1963 p 154–160, 180–188
(JPRS-19995; OTS-63-31185) OTS: $0.75

CONTENTS:

1. THE PROBLEM OF LIVER PATHOCHEMISTRY AFTER INJURY WITH PLUTONIUM-239 N. I. Yelkina and Z. B. Tokarskaya p 1–9 refs (See N64-12571 04-16)

2. THE CONTENT OF ADENOSINE TRIPHOSPHORIC ACID AND CREATINE PHOSPHATE IN THE BRAINS AND MUSCLES OF ANIMALS ADAPTED AND NOT ADAPTED TO THE COLD L. A. Guseva p 10–16 refs (See N64-12572 04-16)

3. THE EFFECT OF IMIPRAMINE ON THE ACTIVITY OF MONOAMINE OXIDASE OF THE CAT BRAIN R. A. Khaunina and I. P. Lapin p 17–22 refs (See N64-12573 04-16)

N64-12571 Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF LIVER PATHOCHEMISTRY AFTER INJURY WITH PLUTONIUM-239

N. I. Yelkina and Z. B. Tokarskaya *In its* Studies in Biochemistry 2 Jul. 1963 p 1–9 refs (See N64-12570 04-16) OTS: $0.75

Rabbit blood plasma protein fraction composition and urea biosynthesis in the liver were investigated after plutonium-239 administration (7 c/kg). In dogs after doses of 2 c/kg, biosynthesis of urea in liver, blood plasma protein fractions, glutaminate-aspartate and glutamate-alanine transaminase and alkaline phosphatase activity were studied. Rabbit and dog blood plasma showed a gradual decrease in total protein content, mainly due to decrease in albumins, after plutonium-239 administration. In dog blood plasma, a gradual increase in transaminase activity was observed; the increase in glutamate-alanine transaminase activity was more distinct as compared with that of glutamate-aspartate transaminase activity. A reduction in urea biosynthesis was noted during the developing of pronounced liver cirrhosis. Blood plasma alkaline phosphatase activity was increased only in cases of distinct liver cirrhosis and jaundice. Albumin content decrease and transaminase activity increase were observed earlier than any morphological manifestations of intoxication. Author

N64-12572 Joint Publications Research Service, Washington, D.C.

THE CONTENT OF ADENOSINE TRIPHOSPHORIC ACID AND CREATINE PHOSPHATE IN THE BRAINS AND MUSCLES OF ANIMALS ADAPTED AND NOT ADAPTED TO THE COLD

L. A. Guseva *In its* Studies in Biochemistry 2 Jul. 1963 p 10–16 refs (See N64-12570 04-16) OTS: $0.75

After cooling for 4 hours at −5°, ATP and creatine phosphate content in the brain of albino mice adapted to cold varied significantly. In muscles, ATP and creatine phosphate were diminished, the creatine phosphate content decrease being more significant than that of ATP. Body temperature in animals adapted to cold did not alter from the initial level. Under similar experimental conditions in nonadapted mice, ATP and creatine phosphate accumulation in brain and muscles was observed. At the same time, body temperature decreased by 6°. Author

N64-12573 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF IMIPRAMINE ON THE ACTIVITY OF MONOAMINE OXIDASE OF THE CAT BRAIN

R. A. Khaunina and I. P. Lapin *In its* Studies in Biochemistry 2 Jul. 1963 p 17–22 refs (See N64-12570 04-16) OTS: $0.75

Cat brain monoamine oxidase activity was estimated in Warburg apparatus with butilamine and noradrenaline as substrates. Imipramin (imozine, tophranil) 1.10^{-5} to 1.10^{-3} M inhibits the enzyme activity in vitro by 14.9 to 30.4 percent. The enzyme activity was inhibited approximately to the same degree by iproniazide (iprazide) and chlorpromazine (aminazine). Inhibitory effect of imipramine and iproniazide on monoamine oxidase increased with increase in drug concentrations, whereas no correlation between the inhibition caused by chlorpromazine and its concentration could be noted. Single and repeated administration of imipramine (5 mg/kg) had no effect on monoamine oxidase activity. Author

N64-12576 Joint Publications Research Service, Washington, D.C.

THE ROLE OF FUNCTIONAL STRESS IN THE LOCALIZATION OF RADIATION INJURY

N. V. Sokolova 3 Jan. 1964 22 p Transl. into ENGLISH of portions of the publ. "Rol' Funktsional'noy Nagruzki v Lokalizatsii Luchevogo Porazheniya", Tomsk, 1962 p 3–5 and 100–115

(JPRS-22586; OTS-64-21195) OTS: $0.75

Research was undertaken in order to better understand the pathogenesis of radiation illness. The results of the experiments demonstrated that organ localization of radiation injury is, to a significant degree, determined by the level of the functional stress of the organ during radiation. R.T.K.

N64-12621 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AUTOMATION AND LIFE

A. N. Kolmogorov 1 Oct. 1963 14 p ref Transl. into ENGLISH from Fiz. Mat. Spisanie (Bulgaria), v. 5, no. 3, 1962 p 198–204

(FTD-TT-63-765/1; AD-424870)

The problems of cybernetics and automation and the realization of the higher nervous activity of the mind which is needed to develop highly complex machines and devices are discussed. The treatment took into consideration the modeling of the activity of the human mind as the basis for automation regardless of the complexity of the particular automation system. But the trend was shown towards leaning away from the idea that the human mind is unique, or rather is to remain unique in the area of thinking and displaying emotion. Argued for is the idea of the possibility of producing machines that can display emotion, multiply and reproduce, go through stages of evolution, and experience will and reason. C.L.W.

N64-12628 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATING THE STATE AND CONVERSIONS OF PIGMENTS IN PURPLE AND GREEN PHOTOSYNTHETIZING BACTERIA

Yu. Ye. Yerokhin and A. A. Krasnovskiy 10 Oct. 1963 20 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 8, no. 4, 1963 p 446–456

(FTD-TT-63-867/1+2; AD-424447)

The employment of sensitive methods for registering spectra in combination with deep cooling of objects made possible the detection of the luminescence of aggregated forms of bacteriochlorophyll and bacteriviridine and the measurement of their spectra. An analysis is given of the results, after a comparative investigation of the state of and certain photochemical properties of pigments of purple and green photosynthesizing bacteria in cells, utilizing the method of measuring luminescence at low temperature. C.L.W.

N64-12634 Library of Congress, Washington, D.C. Aerospace Information Div.

SOVIET BIOASTRONAUTICS

16 Apr. 1963 38 p refs

(AID P-63-48) OTS: $3.60 ph, $1.34 mf

Abstracts are presented that are based on: (1) papers presented by Soviet delegates at the International Symposium on Basic Environmental Problems of Man, held in UNESCO House, Paris, France, from 29 October to 2 November 1962; and (2) a collection of articles published in 1962 by the Department of Biological Sciences, Academy of Sciences U.S.S.R., on the problems of space biology. R.T.K.

N64-12677 School of Aerospace Medicine, Brooks AFB, Tex.

EXCLUSION OF ANGULAR ACCELERATIONS AS THE PRINCIPAL CAUSE OF VISUAL ILLUSIONS DURING PARABOLIC FLIGHT MANEUVERS

Bruce H. Warren, James A. Roman, and Ashton Graybiel (Naval School of Aviation Med.) 13 p refs

(SAM-TDR-63-78; AD-422509)

The angular accelerations produced in the pitch axis during parabolic flights in the F-100F jet aircraft were reversed 180° with reference to the experimental subject. This was accomplished by flying the aircraft upside down during most of the subgravity period. During such reversal of angular accelerations, no difference was noted in the observed apparent displacements of a visual real target and afterimage from those observed when the aircraft was flown right side up. The conclusion is drawn that the angular accelerations resulting in the above maneuvers are not a significant factor in producing visual illusions previously observed and described during the subgravity phase. Author

N64-12701 Joint Publications Research Service, Washington, D.C.

STUDIES IN MOLECULAR GENETICS AND THE EFFECT OF RADIATION ON HEREDITY

N. P. Dubinin 2 Jan. 1964 26 p Transl. into ENGLISH of selections from the book "Molekulyarnaya Genetika i Deystviye na Nasledstvennost", Moscow, 1963 p 3–12 and 236–239

(JPRS-22581; OTS-64-21191) OTS: $0.75

Experimental genetics has found means of acting on the number and specific nature of occurring mutations. In this respect, the achievements of radiation and chemical genetics are particularly great. Their utilization has assured the possibility of actively producing extensive, many-sided hereditary variations in the most varied types of organisms. Along these lines, fruits and vegetables of prime practical importance have been obtained. Also, specifically by methods of radiation and chemical genetics and selection, new strains of lower organisms, which are capable of producing antibiotics, have been created. These new strains produce tens and even hundreds of times larger quantities of antibiotics now being used in the control of various diseases. I.v.L.

N64-12724 Joint Publications Research Service, Washington, D.C.

INCIDENCE OF LEUKOSIS AFTER SINGLE AND FRACTIONATED IRRADIATION

S. N. Aleksandrov and K. F. Galkovskaya *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow, v. 149] no. 1, 1963 12 Jul. 1963 p 14–18 refs (See N64-12722 04-01) OTS: $1.00

The incidence of leukosis in impure-bred strain N mice exposed to 800-r whole-body radiation in a single dose, or in four fractionated doses of 200 r each at 7- or 30-day intervals, was investigated. Among the irradiated animals, 131 cases of leukosis were observed—113 were myeloid forms and 13 lymphoid, with the majority of myeloid forms occurring in males. In general, practically the same incidence of leukosis was noted after the single dose and after the fractionated doses at 7-day intervals; however, increasing the interval between doses to 30 days led to a marked increase in the incidence of leukosis in both males and females. M.P.G.

N64-12725 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF D-C POLES ON ULTRABOUNDARY INHIBITION

N. P. Movchan *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 1, 1963 12 Jul. 1963 p 1–7 refs (See N64-12722 04-01) OTS: $1.00

The effect of a direct electric current on previously established ultraboundary inhibition in dogs was investigated. (Ultraboundary inhibition, also called supraliminal or transmarginal inhibition, represents an inhibition of the intensity of reflexes occurring after a certain tolerance level in the intensity of the stimulus is reached.) A descending current of 2 to 7 ma, applied by using an anode on the head of the dog and a cathode on the back, was found to disinhibit ultraboundary inhibition. An ascending current, on the other hand, preserved the state of ultraboundary inhibition. The behavior of the dogs in the intervals between the conditioned stimuli was not affected by the applied current. Since ultraboundary inhibition serves to protect the cortical nerve cells from possible functional exhaustion and destruction, the use of a direct current to sustain or intensify this protective state may be of practical value. These results also show the catelectrotonic nature of ultraboundary inhibition and permit it to be categorized as a parabiotic type of inhibition. M.P.G.

N64-12747 Joint Publications Research Service, Washington, D.C.

STUDIES ON PROTECTION AGAINST CHEMICAL AGENTS AND RADIATION IN INDUSTRY

5 Dec. 1963 19 p refs Transl. into ENGLISH of 3 articles from Gigiena Truda i Prof. Zabolevaniya (Moscow), no. 10, Oct. 1963 p 3–8, 34–38, 54–55 refs

(JPRS-22154; OTS-63-41302) OTS: $0.50

CONTENTS:

1. HYGIENIC NORMALIZATION OF NEW CHEMICAL AGENTS A. S. Arkhipov p 1–7 (See N64-12748 04-16)

2. THE CONDITION OF THE CAPILLARY CIRCULATION AS CORRELATED WITH HYALURONIDASE ACTIVITY (PERMEABILITY FACTOR) AND BLOOD PROTEIN FRACTIONS DURING CHRONIC IRRADIATION N. I. Gorbarenko and V. A. Bragina p 8–13 refs (See N64-12749 04-16)

3. THE PROBLEM OF PROTECTION OF THOSE WORKING WITH INDUSTRIAL ROENTGENOGRAPHY AND FLUOROSCOPY P. I. Moiseytsev p 14–16 refs (See N64-12750 04-16)

N64-12748 Joint Publications Research Service, Washington, D.C.

HYGIENIC NORMALIZATION OF NEW CHEMICAL AGENTS

A. S. Arkhipov *In its* Studies on Protect. against Chem. Agents and Radiation in Ind. 5 Dec. 1963 p 1–7 (See N64-12747 04-16) OTS: $0.50

The article deals with the establishment of maximally permissible concentrations of chemical substances in the atmosphere of industrial premises. Data are listed on all maximally permissible concentrations accepted in the U.S.S.R. Also discussed is the necessity for some standardization of conditions attending toxicological investigations of maximally-permissible concentrations in relation to the duration of daily poisonings and to the total duration of poisonings in a long-term experiment. Author

N64-12749 Joint Publications Research Service, Washington, D.C.

THE CONDITION OF THE CAPILLARY CIRCULATION AS CORRELATED WITH HYALURONIDASE ACTIVITY (PERMEABILITY FACTOR) AND BLOOD PROTEIN FRACTIONS DURING CHRONIC IRRADIATION

N. I. Gorbarenko and V. A. Bragian *In its* Studies on Protect. against Chem. Agents and Radiation in Ind. 14 Nov. 1961 p 8–13 refs (See N64-12747 04-16) OTS: $0.50

An attempt is made to demonstrate the interrelationship between the condition of the peripheral portion of the vascular system, the capillary permeability, hyaluronidase activity (the permeability factor), and the content of the serum protein fractions during chronic irradiation. The 231 subjects were chosen and divided into four groups, dependent on the degree of expression of their clinical syndrome. All subjects had been exposed to the long-term effect of radiation in X-ray clinics, from gamma-ray flaw detectors and accelerators, or from exposure to continuous-acting luminous materials. Complete test procedures and a summary of results and conclusions are included. J.E.T.

N64-12750 Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF PROTECTION OF THOSE WORKING WITH INDUSTRIAL ROENTGENOGRAPHY AND FLUOROSCOPY

P. I. Moiseytsev *In its* Studies on Protect. against Chem. Agents and Radiation in Ind. 29 Jun. 1961 p 14–16 (See N64-12747 04-16) OTS: $0.50

The value of some recent Soviet publications concerning the problem of radiation protection is discussed. Various types of equipment are suggested for protection against the primary and secondary effects of radiation. J.E.T.

N64-12751 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin

LECTURES FROM THE INSTITUTE FOR FLIGHT-MEDICINE DELIVERED AT THE XI EUROPEAN AERONAUTICAL AND COSMONAUTICAL MEDICAL CONGRESS, MADRID 1962 [VORTRAGE AUS DEM INSTITUT FUR FLUGMEDIZIN]

Sep. 1963 74 p refs GERMAN text with transl. in ENGLISH or FRENCH

(DVL-273) Available from Vereinigte Universitats- u. Fachbuchhandlungen, R. Wagner Str. 1, Cologne, W. Ger.

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4. THE CONDITIONS OF FAT EMBOLISM DURING DECOMPRESSION O. Wünsche and R. H. E. Henn p 33–43 (See N64-12755 04-16)

5. EXPERIMENTAL STUDY ON FAT EMBOLISM IN DECOMPRESSION R. H. E. Henn and O. Wünsche p 48–53 (See N64-12756 04-16)

N64-12753 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin

ALTERATIONS OF VEGETATIVE-HORMONAL STRESS RESPONSES IN MAN FOLLOWING STRESS ADAPTATION

K. E. Klein, H. Brüner, D. Jovy, and H. M. Wegmann *In its* Lectures from the Inst. for Flight-Med. delivered at the XI European Aeron. and Cosmonautical Med. Congr. Sep. 1963 p 19–24 refs (See N64-12751 04-16)

An investigation was made of the number of eosiniphiles in blood and the level of adrenocortical hormones in plasma in order to examine the behavior of the vegetative–hormonal system under adaptation to different stressors. Three groups of people were adapted as follows: group one was adapted to an altitude of 6200 m in the high mountains for 4 weeks continuously; the second was adapted to a simulated altitude of 6000 m in a decompression chamber by exposing them 30 minutes each day for a period of 4 weeks; and the third group was adapted to heat in a climatic chamber by exposing them 40 minutes a day for 4 weeks to 38° C and 85% relative humidity. Graphical results and conclusions are included. J.E.T.

N64-12754 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin

ON THE INFLUENCE OF LONG LASTING HYPOXIA ON THE ORGANIC TRANSAMINASES

K. H. Weiner and G. Schäfer *In its* Lectures from the Inst. for Flight-Med. delivered at the XI Europeam Aeron. and Cosmonautical Med. Congr. Sep. 1963 p 29–32 (See N64-12751 04-16)

Experiments on the changes in activity, of the glutamine acid-oxalacetic acid transaminase (GOT) and the pyrovat acid-oxalacetic acid transaminase (GPT) in liver, kidney, brain, heart, and serum demonstrated the influence of chronic hypoxia on the intermediary metabolism. As shown in earlier experiments on the serum GOT, considerable changes in activity of the transaminases first occurred in the tested organs under chronic hypoxia. After 40 days a steady state developed in all organs. The influence of hypoxia on the transaminase activity varies in the different organs. The experiments were performed on rabbits which were exposed for a period of 40 days to an O_2– partial pressure of 64 mm Hg in a low-pressure chamber. After exposure to oxygen-deficiency, the animals were kept for a further period of 20 days under normal conditions. During this period changes were also seen in the transaminase activity of different organs. Author

N64-12755 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin

THE CONDITIONS OF FAT EMBOLISM DURING DECOMPRESSION DIE BEDINGUNGEN DER FETTEMBOLIE BEI DRUCKERNIEDRIGUNG]

O. Wünsche and R. H. E. Henn *In its* Lectures from the Inst. for Flight-Med. delivered at the XI European Aeron. and Cosmonautical Med. Congr. Sep. 1963 p 33–43 In GERMAN; FRENCH transl. (See N64-12751 04-16)

Two men underwent an unauthorized altitude increase in a decompression chamber. Both used oxygen masks. After 20 minutes, both men were dead, their oxygen masks still in place. Postmorten examinations showed, along with various internal hemorrhages, a distinct nontraumatic fat embolism in the cerebral vessels. This accident led to an investigation of conditions that predispose the occurrence of fat embolism. Rabbits, guinea pigs, and rats were placed in a 15-liter decompression chamber. An altitude of 18,000 meters was chosen as the maximum level of ascent. The speed of ascent varied from 20 seconds to 7 minutes. It was observed that disturbances in the test animals, due to acute oxygen deficiency, occurred at a much higher altitude than they do in man. In order to introduce the disturbance threshold at the highest possible altitude, long-duration ascents were conducted in a pure-oxygen medium. This short exposure to oxygen did not eliminate the body nitrogen and was markedly ineffective on fat tissues, which slowly eliminate nitrogen. I.v.L.

N64-12756 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin

EXPERIMENTAL STUDY ON FAT EMBOLISM IN DECOMPRESSION

R. H. E. Henn and O. Wünsche *In its* Lectures from the Inst. for Flight-Med. delivered at the XI European Aeron. and Cosmonautical Med. Congr. Sep. 1963 p 48–53 (See N64-12751 04-16)

Pictorial and graphical results are presented for the conditions and pathological findings of fat embolism caused by decompression. Rats, rabbits, and guinea pigs were the subject animals. Experimental procedures are described, and it is concluded that fat embolism in decompression is possible if: (1) there is no critical atmospheric hypoxydosis, in order to prevent premature suffocation; (2) the circulation is not severely disturbed by gas embolism; and (3) the ascent is fast enough to allow fat cells to rupture as a result of accumulating nitrogen (and yet slow enough to prevent severe gas-bubble formation). The importance of the rate of pressure change in the development of fat embolism is emphasized. J.E.T.

N64-12764 Joint Publications Research Service, Washington, D.C.

STUDIES IN BURN TREATMENT, BLOOD STRUCTURES, AND RADIATION SICKNESS

N. T. Shutova et al 9 Dec. 1963 47 p refs Transl. into ENGLISH of 8 articles from Patol. Fiziol. i Eksperim. Terapiya (Moscow), v. 7, no. 4, Jul.–Aug. 1963 p 3–10, 27–34, 40–45, 64–65, and 69–73

(JPRS-22180; OTS-63-41311) OTS: $1.25

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1. THE PROBLEM OF HEREDITY N. T. Shutova p 1–10 refs (See N64-12765 04-16)

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3. THE PROPERDIN SYSTEM IN BURNS A. M. Yakovlev, O. S. Krasnopevtseva, G. G. Komleva, and S. D. Yakovleva p 17–22a refs (See N64-12767 04-16)

4. THE USE OF BLOOD SUBSTITUTES AND OXIDATION OF THE INTERMEDIATE METABOLIC PRODUCTS DURING REANIMATION AFTER CLINICAL DEATH O. N. Bulanova, and I. O. Zaks p 23–30a refs (See N64-12768 04-16)

5. THE PROTECTIVE AND THERAPEUTIC EFFECTS OF THE SOMATOTROPIC HORMONE IN ACUTE RADIATION SICKNESS S. A. Davydova p 31–33 refs (See N64-12769 04-16)

6. METHOD OF INFLICTING BURNS ON THE RESPIRATORY TRACT EXPERIMENTALLY V. N. Khrebtovich p 34–37 refs (See N64-12770 04-16)

7. SENSITIVE METHOD FOR DETECTING WEAK ANTIBODIES Ye. A. Zotikov, R. M. Urinson, and L. P. Poreshina p 38–40 (See N64-12771 04-16)

8. THE BLOOD CLOTTING SYSTEM AND ITS DISORDERS (STUDY SCHEME) V. S. Gigauri and R. F. Yurin p 41–44 (See N64-12772 04-16)

N64-12765 Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF HEREDITY

N. T. Shutova *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 1–10 refs (See N64-12764 04-16) OTS: $1.25

A survey is presented of the progress that has been made in genetics and the study of heredity. A discussion is given of the importance of the carrier of the hereditary information and the genetic code in the DNA molecule, which is converted into the specific protein structure in the cell by means of RNA and therefore determines the properties of a living system. R.T.K.

N64-12766 Joint Publications Research Service, Washington, D.C.

THE TREATMENT OF SEVERE BURN SHOCK BY INTRA-ARTERIAL INFUSION OF A BLOOD SUBSTITUTE UNDER LOW PRESSURE

V. B. Lemus *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 11–16 refs (See N64-12764 04-16) OTS: $1.25

This paper deals with the results of treating severe experimental burn shock in rabbits by intra-arterial injection of Petrov's fluid blood substitute under diverse pressure. The best therapeutic effect was obtained following injection of small amounts of the fluid under pressure exceeding the arterial pressure level by only 10 mm Hg; in these cases the reflex control of the vascular tone was partially restored, and arterial pressure rose from 60 to 86–116 mm Hg. Treatment by this method did not prevent the development of hypothermia, and was often accompanied by further thickening of the blood. Author

N64-12767 Joint Publications Research Service, Washington, D.C.

THE PROPERDIN SYSTEM IN BURNS

A. M. Yakovlev, O. S. Krasnopevtseva, G. G. Komleva, and S. D. Yakovleva *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 17–22a refs (See N64-12764 04-16) OTS: $1.25

The content of properdin in the blood serum of 89 patients with burns and 26 donors was investigated. In the days immediately following the burn trauma, there was a reduction of the properdin level in the patients' blood. Reduction of the properdin content corresponded to the severity of the condition and was especially pronounced in the group of patients with extensive burns. In gravely ill patients the properdin titre normalized slowly, was unstable, and at times considerably decreased during the course of the disease. Increase or decrease of the properdin level observed during the course of the disease was in a number of cases connected with infectious complications or bacteremia. Author

N64-12768 Joint Publications Research Service, Washington, D.C.

THE USE OF BLOOD SUBSTITUTES AND OXIDATION OF THE INTERMEDIATE METABOLIC PRODUCTS DURING REANIMATION AFTER CLINICAL DEATH

O. N. Bulanova, and I. O. Zaks *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 23–30a refs (See N64-12764 04-16) OTS: $1.25

Complete blood substitution (200 percent of the total blood volume) was carried out in the initial restorative period after clinical death caused by blood loss. The amount of organic acid was determined for the blood plasma of recipient and donor. Blood substitution had a marked positive effect on the restoration of functions and survival of the animals. There was a drop in the concentration of organic acids in the blood of the recipient directly after substitution; however, a rise was noted later, and the concentration was high for a prolonged period of time. A considerable amount of organic acid was eliminated with the blood drained during substitution. Only a transient and insignificant rise of organic acid content ensued after replacement of the blood of healthy animals with the blood of donors that had sustained clinical death. The amount of organic acid in the blood of the latter exceeded the normal value 2.5 to 3 times. It was concluded that the high organic acid content, persisting for a long time in the blood of resuscitated animals, is caused not only by the gradual washing out of the initial amount of acid from the tissues, but also by disturbed oxidation processes. Author

N64-12769 Joint Publications Research Service, Washington, D.C.

THE PROTECTIVE AND THERAPEUTIC EFFECTS OF THE SOMATOTROPIC HORMONE IN ACUTE RADIATION SICKNESS

S. A. Davydova *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 31–33 refs (See N64-12764 04-16) OTS: $1.25

Male white rats were irradiated with gamma rays of Co^{60} in doses of 700 to 750 r with a dose rate at the source of 324 to 440 r per minute. For prophylaxis, STH (somatotropic hormone) was given every day for 10 days before irradiation; as a therapeutic agent, for the first 6 days after the irradiation, beginning with the first day of the experiment. After irradiation with a dose of 750 r, in one of the series of experiments, STH was used in combination with biomycin (aureomycin). Prophylactic use of STH failed to exert any protective effect. After irradiation, the weight losses in animals which had first been given STH were less pronounced than in the controls. The radioresistance of rats administered STH during the latent period and at the beginning of clinical manifestations of radiation sickness showed a statistically significant increase in the survival rate. A combination of STH with biomycin did not increase the survival of irradiated animals. R.T.K.

N64-12770 Joint Publications Research Service, Washington, D.C.

METHOD OF INFLICTING BURNS ON THE RESPIRATORY TRACT EXPERIMENTALLY

V. N. Khrebtovich *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 34–37 refs (See N64-12764 04-16) OTS: $1.25

A method is described for inflicting burns on the respiratory tract of animals which have not been anesthetized. The animals are tied to a vivisection stand, and spontaneously inhale the thermal agent. In the series of experiments designed to test the effectiveness of the method, a glass tube was fixed in the mouth with bandages; the glass tube was insulated with a mixture of asbestos and fire clay; for inflicting a flame burn, a tube with an expanded outer end was used. Inhalation of hot air at a temperature of 400° to 450° C caused burns of the upper respiratory tract. On the tongue and upper palate, areas of a deep lesion occurred with necrosis of the mucous membrane. The changes in the lungs were

slight. When the temperature of the inhaled air was 500° to 550° C the changes were more pronounced. Inhalation of flames of hot alcohol for 30 seconds was accompanied by extensive injuries to the soft tissues and sometimes to the cartilages of the larynx. The trachea was almost always affected, and in some cases the large bronchi were also affected. R.T.K.

N64-12771 Joint Publications Research Service, Washington, D.C.
SENSITIVE METHOD FOR DETECTING WEAK ANTIBODIES
Ye. A. Zotikov, R. M. Urinson, and L. P. Poreshina *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 38–40 (See N64-12764 04-16) OTS: $1.25

A test plan is described that makes it possible to increase the sensitivity of methods for detecting weak antibodies. The test is based on determination of the antiglobulin specifically adsorbed on erythrocytes. Study of the sera containing antibodies in low titer made it possible to note a higher sensitivity for this method than for the Coombs test. R.T.K.

N64-12772 Joint Publications Research Service, Washington, D.C.
THE BLOOD CLOTTING SYSTEM AND ITS DISORDERS (STUDY SCHEME)
V. S. Gigauri and R. F. Yurin *In its* Studies in Burn Treat., Blood Struct., and Radiation Sickness 9 Dec. 1963 p 41–44 (See N64-12764 04-16) OTS: $1.25

A method is described for teaching students the principles involved in blood clotting. R.T.K.

N64-12776 Joint Publications Research Service, Washington, D.C.
PROBLEMS IN EARLY DIAGNOSIS OF ACUTE RADIATION SICKNESS
S. N. Ledanova, ed. 27 Nov. 1963 90 p refs Transl. into ENGLISH of 8 articles and the table of contents from the book "K voprosam ranney diagnostiki ostroy luchevoy bolezni", Kiev, State Med. Publishing House Ukrain. SSR, 1962 (JPRS-22049; OTS-63-41239) OTS: $2.25

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2. EARLY CHANGES IN THE PROTEIN COMPOSITION OF BLOOD SERUM DURING ACUTE RADIATION SICKNESS O. V. Fastyuchenko, L. Ya. Popova, and M. G. Nikolayeva p 17–25 refs (See N64-12778 04-16)

3. CHANGES IN PROTEIN METABOLISM DURING RADIATION SICKNESS I. V. Savitskiy and Ye. M. Vasyutinskaya p 26–35 refs (See N64-12779 04-16)

4. CHANGES IN THE PROTEIN METABOLISM OF DOGS GIVEN COMPREHENSIVE TREATMENT FOR ACUTE RADIATION SICKNESS Ye. Ye. Chebotarev and N. I. Kerova p 36–48 refs (See N64-12780 04-16)

5. CHANGES IN THE NUCLEIC ACIDS OF RAT SPLEEN AND BONE MARROW IN ACUTE RADIATION SICKNESS O. V. Fastyuchenko, L. Ya. Popova, and M. G. Nikolayeva p 49–57 refs (See N64-12781 04-16)

6. LUMINESCENT INVESTIGATIONS OF FORMED ELEMENTS OF THE BLOOD AND BONE MARROW IN THE EARLY STAGES OF RADIATION INJURY Ye. V. Piskareva p 58–67 refs (See N64-12782 04-16)

7. EARLY CHANGES IN THE TOXICITY OF RAT BLOOD PLASMA IN ACUTE RADIATION SICKNESS A. K. Arnautov and G. K. Dzhafarov p 68–76 refs (See N64-12783 04-16)

8. EARLY HUMAN SKIN REACTIONS TO ACUTE LOCAL EXPOSURE TO ROENTGEN AND COBALT GAMMA RAYS V. S. Genes, A. I. Il'yevich, and A. I. Kogan p 77–83 refs (See N64-12784 04-16)

N64-12777 Joint Publications Research Service, Washington, D.C.
CHARACTERISTICS OF EARLY DAMAGE TO BLOOD PROTEIN STABILITY IN THE DEVELOPMENT OF RADIATION INJURY ACCORDING TO THE RESULTS OF INVESTIGATION OF THE HEAT EMISSION OF ITS SOLUTIONS
V. K. Tkach *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 1–16 refs (See N64-12776 04-16) OTS: $2.25

The thermal properties of blood solutions were studied in order to determine the origin and development of radiation lesions. Structural-energy features and changes in blood proteins were found to parallel the different stages of development of radiation lesions. The difference in the nature of the changes with time in the coefficients characterizing the thermal properties of solutions of proteins and blood from irradiated and nonirradiated animals showed that the use of thermal investigations to study impairment of protein structure, as well as to make some assumptions concerning the mechanism involved, was possible. R.T.K.

N64-12778 Joint Publications Research Service, Washington, D.C.
EARLY CHANGES IN THE PROTEIN COMPOSITION OF BLOOD SERUM DURING ACUTE RADIATION SICKNESS
O. V. Fastyuchenko, L. Ya. Popova, and M. G. Nikolayeva *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 17–25 refs (See N64-12776 04-16) OTS: $2.25

The changes in the total content of proteins in the blood serum (and its fractions) after exposure to whole-body irradiation were studied in animals. Results show that the total blood-serum protein content tends to decrease within an hour after X-irradiation—the total content increases in proportion to the dose and time elapsing following exposure. Soon after exposure to all the doses investigated, the albumins decrease in serum whereas the globulins increase. Besides an increase in the entire globulin fraction, there was also an increase in its individual subfractions (α, β, and γ). R.T.K.

N64-12779 Joint Publications Research Service, Washington, D.C.
CHANGES IN PROTEIN METABOLISM DURING RADIATION SICKNESS
I. V. Savitskiy and Ye. M. Vasyutinskaya *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 26–35 refs (See N64-12776 04-16) OTS: $2.25

The protein metabolism of rabbits exposed to X-rays and injected with toxic doses of radiophosphorus was investigated. Signs of developing radiation sickness were changes in the blood proteins and in residual nitrogen. Changes in residual nitrogen fibrinogen were more consistent than those in the albumins and globulins. Massive doses of radiation were found to increase the content of blood-serum globulins while lowering the albumin level. Abnormalities in protein metabolism, following external and internal radiation, were demonstrated. In both cases, the concentration of fibrinogen and residual nitrogen rises, and there are some changes in the albumins and globulins. R.T.K.

N64-12780 Joint Publications Research Service, Washington, D.C.

CHANGES IN THE PROTEIN METABOLISM OF DOGS GIVEN COMPREHENSIVE TREATMENT FOR ACUTE RADIATION SICKNESS

Ye. Ye. Chebotarev and N. I. Kerova *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 36–48 (See N64-12776 04-16) OTS: $2.25

Whole-body irradiation of dogs with a dose of 600 r was found to cause changes in the ratio of blood-serum protein fractions, with an increase in the globulins and a decrease in the albumins. The albumin–globulin ratio decreased. At the same time, nitrogen metabolism was severely impaired being manifested by hypoproteinemia, azotemia, and increased excretion of total and residual nitrogen in the urine. These changes signified rapid decomposition of proteins in the irradiated organism. The prophylactic injection of an arylthiocarbohydrazide derivative 1 hour before irradiation increased the survival time of the animals, and the characteristic symptoms of radiation sickness were less pronounced in these animals than in the control animals. Regeneration of the blood serum proteins after irradiation took 90 days in the control animals and 30 to 40 days in the experimental animals. R.T.K.

N64-12781 Joint Publications Research Service, Washington, D.C.

CHANGES IN THE NUCLEIC ACIDS OF RAT SPLEEN AND BONE MARROW IN ACUTE RADIATION SICKNESS

O. V. Fastyuchenko, L. Ya. Popova, and M. G. Nikolayeva *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p49–57 refs (See N64-12776 04-16) OTS: $2.25

Changes in nucleic acid metabolism in the hematopoietic organs (spleen, thigh bone marrow) were investigated after a series of successively larger doses of X-ray. The experiments were performed on white rats irradiated once with doses of 150, 300, 450, 600, 750, 900, 1050, and 1200 r. The organs were investigated 1, 24, 48, and 72 hours after irradiation. After the animals were irradiated with the various doses of X-rays, there was a decrease in the nucleic acid content of the spleen and marrow. The most pronounced decrease occurred 24 hours after exposure. The greatest changes in RNA content of the spleen and marrow occurred 1 to 24 hours after irradiation exposure to 300-, 450, and 1050-r doses, and in DNA contents after exposure to 300-, 450-, 750-, 1050-, and 1200-r doses. The greatest decrease in RNA content occurred 48 to 72 hours after irradiation with 600- and 750-r doses, and in DNA content after 600-, 750-, 1050-, and 1200-r doses. After large doses (900 and 1200 r) the RNA content returns to the original level and occasionally exceeds it. The absence of parallelism between the size of the dose and the resultant effect indicated that different doses affect different systems of the organism. R.T.K.

N64-12782 Joint Publications Research Service, Washington, D.C.

LUMINESCENT INVESTIGATIONS OF FORMED ELEMENTS OF THE BLOOD AND BONE MARROW IN THE EARLY STAGES OF RADIATION INJURY

Ye. V. Piskareva *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 58–67 refs (See N64-12776 04-16) OTS: $2.25

Fluorescent microscopy (in blue light) was used to study the formed elements of the blood of rats and rabbits and the bone marrow of rats that had been exposed to ionizing radiation. The cells were stained with fluorochromes. Results of the investigation indicated that the changes occurring after irradiation were not specific. The appearance of erythrocyte luminescence was found to occur both in nonirradiated animals as well as in animals that had been subjected to irradiation. The irradiated animals were found to have low leukocyte resistance to heat. The changes that take place in the organism in the early stages of radiatjon sickness, as determined by various methods, were found to move in the same direction—they are phasic. R.T.K.

N64-12783 Joint Publications Research Service, Washington, D.C.

EARLY CHANGES IN THE TOXICITY OF RAT BLOOD PLASMA IN ACUTE RADIATION SICKNESS

A. K. Arnautov and G. K. Dzhafrov *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 68–76 refs (See N64-12776 04-16) OTS: $2.25

After single whole-body irradiation of rats with doses ranging from 450 to 1200 r, the blood plasma was found to contain substances toxic to paramecia (*Paramecium caudatum*). Toxicity was found to decrease on the first 2 days after irradiation with 150- and 300-r doses; however, toxicity increased on the third day after irradiation with the 150-r dose. Single whole-body irradiation of rats with a dose of 1500 r caused a decrease in the toxic substances of the rat blood plasma throughout the observation period. R.T.K.

N64-12784 Joint Publications Research Service, Washington, D.C.

EARLY HUMAN SKIN REACTIONS TO ACUTE LOCAL EXPOSURE TO ROENTGEN AND COBALT GAMMA RAYS

V. S. Genes, A. I. Il'yevich, and A. I. Kogan *In its* Probl. in Early Diagn. of Acute Radiation Sickness 27 Nov. 1963 p 77–83 refs (See N64-12776 04-16) OTS: $2.25

An investigation was undertaken in order to find simple and clear-cut techniques for detecting early skin changes due to the influence of irradiation doses with different penetrating power. X-rays of 200 kv and a 250-r dose of cobalt gamma rays were used. The following indices of the functional state of elements of the skin and its adnexa were used: (1) tactile and pain sensitivity; (2) skin sensitivity to direct current; (3) skin temperature; (4) perspiration; (5) pilomotor reaction to chilling the skin with ether; (6) capillary fragility; and (7) leukocyte count in capillary blood in the skin areas investigated. The subjects were 32 women suffering from II-II degree cancer of the cervix uteri. The skin reaction was studied in both buttocks before and after either buttock was irradiated. The results of the study indicated that the aforementioned methods cannot be used for early detection of skin changes due to irradiation. R.T.K.

N64-12793 Joint Publications Research Service, Washington, D.C.

SOVIET RESEARCH ON RADIATION EFFECTS

M. D. Pomerantseva et al 29 Nov. 1963 25 p refs Transl. into ENGLISH of four articles from Dokl. Akad. Nauk SSSR, (Moscow), v. 151, no. 1, 1963

(JPRS-22083; OTS-63-41258) OTS: $0.75

1. GENETIC CONSEQUENCES OF THE ACTION OF FAST NEUTRONS ON MOUSE SPERM M. D. Pomerantseva and L. K. Ramayya p 1–5 refs (See N64-12794 04-16)

2. DYNAMICS OF POSTRADIATION RESTORATION OF YEAST CELLS IN RELATION TO THE DOSAGE OF GAMMA RADIATION V. S. Barsukov, O. V. Malinovskiy, and N. M. Mityushova p 6–11 refs (See N64-12795 04-16)

3. REPARATIVE REGENERATION OF RAT LIVER AFTER LOCAL X-IRRADIATION M. M. Kalashnikova p 12–18 refs (See N64-12796 04-16)

4. STUDY OF THE SHIELDING ACTION OF CYSTAMINE ON EHRLICH'S ASCITIC CARCINOMA IRRADIATED IN VIVO AND IN VITRO I. V. Nekrasova p 19–22 refs (See N64-12797 04-16)

N64-12794 Joint Publications Research Service, Washington, D.C.

GENETIC CONSEQUENCES OF THE ACTION OF FAST NEUTRONS ON MOUSE SPERM

M. D. Pomerantseva and L. K. Ramayya *In its* Soviet Res. on Radiation Effects 29 Nov. 1963 p 1–5 refs (See N64-12793 04-16) OTS: $0.75

The rate at which dominant lethal mutations appeared in spermatozoa and spermatids served as an indicator of the genetic effects of the action of fast neutrons on mouse sperm. Results demonstrated that as the dose of fast neutrons increased there was a proportionate increase in the number of dead embryos from the nonirradiated females mated with the irradiated males. There was an exponential relationship between the frequency with which dominant lethal mutations appeared and the dose of fast neutrons. The effectiveness of fast neutrons on spermatozoa was found to be almost four times greater than after X-irradiation. On spermatids, the relative biological effectiveness of fast neutrons was lower than for spermatozoa. R.T.K.

N64-12795 Joint Publications Research Service, Washington, D.C.

DYNAMICS OF POSTRADIATION RESTORATION OF YEAST CELLS IN RELATION TO THE DOSAGE OF GAMMA RADIATION

V. S. Barsukov, O. V. Malinovskiy, and N. M. Mityushova *In its* Soviet Res. On Radiation Effects 29 Nov. 1963 p 6–11 refs (See N64-12793 04-16) OTS: $0.75

The restoration of the capacity for unlimited multiplication of yeast cells, with different ploidy, after gamma irradiation was investigated. The restoration rate was found to decrease as the dose was increased. Throughout the range of doses, the restoration rate for diploid cells was found to be lower than the rate for tetraploids. R.T.K.

N64-12796 Joint Publications Research Service, Washington, D.C.

REPARATIVE REGENERATION OF RAT LIVER AFTER LOCAL X-IRRADIATION

M. M. Kalashnikova *In its* Soviet Res. On Radiation Effects 29 Nov. 1963 p 12–18 refs (See N64-12793 04-16) OTS: $0.75

An investigation was made of the effects of local irradiation on the liver. Male white rats were the experimental animals, and they were exposed to single, local X-irradiation in the liver region with a dose of 1000 *r*. Irradiating the liver resulted in the formation of small necrotic foci in the liver parenchyma, vacuolation of the cytoplasm, impairment of nuclear structure, and atypical mitoses. The liver was found to react to subtotal hepatectomy and to irradiation in the same way in the form of hyperemia, appearance of mitoses, and hypertrophy of the cunleoli, but in the case of irradiation these processes set in later, and there was atypical mitoses. The effect of irradiation on the liver following partial excision included inhibition of the leukocyte and connective tissue reaction, appearance of atypical mitoses, and, in the younger animals, marked edema. R.T.K.

N64-12797 Joint Publications Research Service, Washington, D.C.

STUDY OF THE SHIELDING ACTION OF CYSTAMINE ON EHRLICH'S ASCITIC CARCINOMA IRRADIATED IN VIVO AND IN VITRO

I. V. Nekrasova *In its* Soviet Res. On Radiation Effects 29 Nov. 1963 p 19–22 refs (See N64-12793 04-16) OTS: $0.75

The results of comparative studies of the antiradiation activity of cystamine and cysteamine on Ehrlich's ascitic carcinoma when irradiated in the abdominal cavity of mice and *in vitro* are discussed. The results demonstrated that both cysteamine and cystamine are almost equally effective in reducing the percentage of cells with chromosomal aberrations caused by irradiation, provided that the tumor cells were irradiated in the animal's abdominal cavity, but only cysteamine exerted protective action when they were irradiated *in vitro*. In this event the cysteamine antiradiation activity was approximately the same as when the cells were irradiated *in vivo*. Cystamine, however, when added to the ascitic fluid *in vitro*, had no perceptible effect on radiation injury according to the criterion under investigation. R.T.K.

N64-12801 Joint Publications Research Service, Washington, D.C.

SOVIET STUDIES OF RADIATION SICKNESS

V. V. Antipov et al 2 Jul. 1963 21 p refs Transl. into ENGLISH of 4 articles from Med. Radiol. (Moscow), v. 8, no. 4, Apr. 1963 p 81–92 (JPRS-19996; OTS-63-31186) OTS: $0.50

CONTENTS:

1. TESTS OF TRYPTAMINE (3-BETA-AMINOETHYLINDOLE HYDROCHLORIDE) FOR ACUTE RADIATION SICKNESS IN MICE V. V. Antipov p 1 (See N64-12802 04-16)

2. THE EFFECT OF ULTRAVIOLET RADIATION ON THE COURSE OF RADIATION SICKNESS V. D. Abdullayev p 2–3 refs (See N64-12803 04-16)

3. REVIEW OF BOOK BY F. M. LYASS, ISOTOPIC MYELOGRAPHY [IZOTOPNAYA MIYELOGRAFIYA] N. K. Muratkhodzhayev p 4–5

4. CONFERENCE ON PROBLEMS OF THE PATHOGENESIS, EXPERIMENTAL PROPHYLAXIS AND THERAPY OF RADIATION INJURY O. V. Popov p 6–18 refs (See N64-12804 04-16)

N64-12802 Joint Publications Research Service, Washington, D.C.

TESTS OF TRYPTAMINE (3-BETA-AMINOETHYLINDOLE HYDROCHLORIDE) FOR ACUTE RADIATION SICKNESS IN MICE

V. V. Antipov *In its* Soviet Studies of Radiation Sickness 2 Jul. 1963 p 1 (See N64-12801 04-16) OTS: $0.50

The effect of tryptamine, when used for a long time, on the formation of hemorrhages (petechiae) in irradiated mice was investigated. Results indicated that tryptamine doses of 10 to 25 milligrams per kilogram of specimen body weight, when injected intraperitoneally for 5 to 7 days, beginning with the second day after irradiation, exerted no effect on the formation of petechiae. I.v.L.

N64-12803 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF ULTRAVIOLET RADIATION ON THE COURSE OF RADIATION SICKNESS

V. D. Abdullayev *In its* Soviet Studies of Radiation Sickness 2 Jul. 1963 p 2–3 refs (See N64-12801 04-16) OTS: $0.50

The effect of high doses of ultraviolet rays in whole-body radiation injuries in white rats was investigated. Results indicate: (1) Ultraviolet irradiation of animals in high doses (total dose of 24,000,000 ergs/cm^2 before and after a single whole-body X-ray irradiation in a sublethal dose, 500 r) aggravates the course of radiation sickness, which was expressed in an increase in the number of animals which died, a shortening of their lifespans, and a less rapid recovery of weight when compared with the controls. (2) The use of a dose of ultraviolet irradiation several times greater than that used heretofore not only fails to contribute to reducing the degree of radiation injury but even enhances its development. I.v.L.

N64-12804 Joint Publications Research Service, Washington, D.C.

CONFERENCE ON PROBLEMS OF THE PATHOGENESIS, EXPERIMENTAL PROPHYLAXIS AND THERAPY OF RADIATION INJURY

O. V. Popov *In its* Soviet Studies of Radiation Sickness 2 Jul. 1963 p 6-18 refs (See N64-12801 04-16) OTS: $0.50

Excerpts from various reports concerning the problems of the pathogenesis, experimental prophylaxis, and therapy of radiation injury are presented. I.v.L.

N64-12811 Atomic Energy Commission, Washington, D.C. Div. of Tech. Information

RESEARCH AND DEVELOPMENT IN PROGRESS: BIOLOGY AND MEDICINE

Nov. 1963 331 p refs

(TID-4201)

AEC-sponsored biomedical research projects in progress at AEC laboratories and major contractor sites are cited. The approximately 600 projects identified, summarized, and indexed herein, along with the offsite projects reported in TID-4200, constitute virtually complete coverage of all research projects administered by the AEC Division of Biology and Medicine during fiscal year 1963. The first section provides a scope note or abstract and identifying information on each project. The second section consists of contractor, principal investigator, contract number, and subject indexes. Major topics of discussion include somatic effects of radiation, radiation genetics, combating detrimental effects of radiation, molecular and cellular level studies, environmental radiation studies, radiological and health physics, chemical toxicity, nuclear-energy civil effects, and cancer research. J.E.T.

N64-12835 Harvard U., Boston Medical School

CATECHOLAMINE RELEASE FROM ADRENAL SLICES AND RATE OF RESPIRATION

P. R. Draskoczy, W. R. Burack, and N. Weiner Brooks AFB, Tex., School of Aerospace Med., Sep. 1963 12 p refs

(Contract AF 41(657)-414)

(SAM-TDR-63-50; AD-421848)

The oxygen consumption of, and the catecholamine release from, incubated fowl adrenal slices were studied under control conditions and during exposure to several chemical agents—i.e., potassium ion, reserpine, tyramine, and 2,4-dinitrophenol. Potassium ion, given as KCl, 0.1 M, and tyramine, 7.3 × 10^{-3} M, did not alter the respiration rate but did increase the rate of catecholamine release. Reserpine, 3.3 × 10^{-5} M, depressed the rate of respiration but did not affect the rate of release of catecholamines. The 2,4-dinitrophenol, 7 × 10^{-5} M, caused an immediate, marked increase in oxygen consumption unaccompanied by any change in the rate of release of catecholamines over a period of 2 hours. Subsequently, the rate of release exceeded control values. Author

N64-12845 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BIONICS

A. I. Prokhorov 5 Aug. 1963 83 p Transl. into ENGLISH of the book "Bionika", Moscow, Izd. "Znaniya" Vses. obshch. po resprostraneniyu znaniy, 1963 p 1-56

(FTD-TT-63-557/1+4; AD-421190)

Problems of bionics, achievements in the field of bionics, and the outlook for the technical use of bionics are discussed in a nontechnical manner. P.V.E.

N64-12855 School of Aerospace Medicine, Brooks AFB, Tex.

EFFECT OF VENTILATING AIR FLOW ON HUMAN WATER REQUIREMENTS

B. E. Welch, R. G. Cutler, J. E. Herlocher, J. J. Hargreaves, F. Ulvedal et al Oct. 1963 14 p refs

(SAM-TDR-63-59; AD-426008)

This paper presents the results of a preliminary experiment designed to study water requirements of men wearing partially donned and fully donned pressure suits. The 13-day test was conducted at an altitude of 27,000 ft in an atmosphere of essentially 100% oxygen. The pressure suits were similar to standard pressure garments except the arms and legs were detachable at the middle of the upper arm and leg. Ventilating airflow was provided by means of onboard, high-speed centrifugal compressors. Water requirements were determined by measuring water intake and output, as well as urine osmolarity, specific gravity, blood hematocrit, and urea nitrogen. Water requirements were found to increase over previously noted values at this altitude. This increase was reflected by a slight decrease in urine volume and by an increase in water lost through the lungs and skin. Author

N64-12864 School of Aerospace Medicine, Brooks AFB, Tex.

TIME-CONCENTRATION EFFECTS IN RELATION TO OXYGEN TOXICITY IN MAN

B. E. Welch, T. E. Morgan, Jr., and H. G. Clamann Oct. 1963 16 p refs

(*Its* Aeromed. Rev. 9-63)

This paper attempts to bring together salient features of research conducted at high and low oxygen partial pressure, in an effort to stimulate additional research to fill the many gaps in man's knowledge and understanding of oxygen. C.L.W.

N64-12865 School of Aerospace Medicine, Brooks AFB, Tex.

A RESTRAINT APPARATUS FOR THORACIC ROENTGENOGRAPHIC EXAMINATION OF UNANESTHETIZED PRIMATES

Robert J. Young Nov. 1963 8 p refs

(SAM-TDR-63-93; AD-425542)

An apparatus to immobilize a small primate during chest radiography is described. The use of this apparatus with proper exposure factors will produce radiographs of sufficient clarity to permit the detection of pulmonary tuberculosis. Author

N64-12883 Joint Publications Research Service, Washington, D.C.

STUDIES ON DEOXYRIBONUCLEASE

R. I. Salganik et al 27 Nov. 1963 13 p refs Transl. into ENGLISH of 2 articles from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Biologo-Med. Nauk (Novosibirsk), no. 8, issue 2, 1963 p 99-107

(JPRS-22050; OTS-63-41240) OTS: $0.50

CONTENTS:

1. ACTION OF DEOXYRIBONUCLEASE ON THE PROPAGATION OF ADENOVIRUS IN TISSUE CULTURE R. I. Salganik and A. A. Trukhachev p 1–4 refs (See N64-12884 04-16)

2. CLINICAL TESTING OF DEOXYRIBONUCLEASE IN ADENOVIRAL CONJUNCTIVITIS N. I. Morozkin and R. Ya. Khersonskaya p 5–10 refs (See N64-12885 04-16)

N64-12884 Joint Publications Research Service, Washington, D.C.

ACTION OF DEOXYRIBONUCLEASE ON THE PROPAGATION OF ADENOVIRUS IN TISSUE CULTURE

R. I. Salganik and A. A. Trukhachev *In its* Studies on Deoxyribonuclease 27 Nov. 1963 p 1–4 refs (See N64-12883 04-16) $0.50

An investigation was made of the capacity of deoxyribonuclease, DNAase, to inhibit the propagation of DNA-containing viruses that are pathogenic for man; one type is the adenovirus which causes lesions of the respiratory tract, severe keratitis, and conjunctivitis. The effect of DNAase was found to inhibit the development of the cytopathogenic effect of the virus. The clinical effectiveness of DNAase in human diseases caused by adenoviruses was also investigated. DNAase was found to be an effective therapeutic agent.

R.T.K.

N64-12885 Joint Publications Research Service, Washington, D.C.

CLINICAL TESTING OF DEOXYRIBONUCLEASE IN ADENOVIRAL CONJUNCTIVITIS

N. I. Morozkin and R. Ya. Khersonskaya *In its* Studies on Deoxyribonuclease 27 Nov. 1963 p 5–10 refs (See N64-12883 04-16) OTS: $0.50

The therapeutic effectiveness of deoxyribonuclease, DNAase, in the treatment of patients with adenovirus conjunctivitis was demonstrated clinically. Early use of the enzyme was effective in the treatment of membranous conjunctivitis and keratitis.

R.T.K.

N64-12886 Joint Publications Research Service, Washington, D.C.

SOVIET RESEARCH IN RADIOLOGY

T. V. Tarapina et al 29 Nov. 1963 14 p refs Transl. into ENGLISH of 2 articles from Dokl. Akad. Nauk SSSR (Moscow), v. 152, no. 1, 1963 p 202–204 and 215–217 (JPRS-22082; OTS-63-41257) OTS: $0.50

CONTENTS:

1. THE EFFECT OF IONIZING RADIATION ON MAMMALIAN HEART MUSCLE T. V. Tarapina p 1–6 refs (See N64-12887 04-16)

2. DECREASE IN THE EFFECTIVENESS OF THE SHIELDING ACTION OF CYSTEAMINE AFTER REPEATED IRRADIATION S. N. Aleksandrov and K. F. Galkovskaya p 7–11 refs (See N64-12888 04-16)

N64-12887 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF IONIZING RADIATION ON MAMMALIAN HEART MUSCLE

T. V. Tarapina *In its* Soviet Res. in Radiol. 29 Nov. 1963 p 1–6 refs (See N64-12886 04-16) OTS: $0.50

A detailed study was made based on experiments with white rats given whole body irradiation to determine if X-rays have an effect on the heart. Tests revealed that the fiber of the heart undergoes reactive and destructive changes after animals are irradiated with a dose of 600 rads. The destructive changes are most apparent at the climax of the radiation sickness and achieve a maximum in the dying and dead animals between 8 and 16 to 20 days later. An asymptomatic state is then followed by the loss of transverse striation, vacuolation, Zenkers degeneration of muscular fibers, and fatty degeneration. The glycogen level of the muscular fibers is lowered, and the formation of large clumps and drops is observed.

C.L.W.

N64-12888 Joint Publications Research Service, Washington, D.C.

DECREASE IN THE EFFECTIVENESS OF THE SHIELDING ACTION OF CYSTEAMINE AFTER REPEATED IRRADIATION

S. M. Aleksandrov and K. F. Galkovskaya *In its* Soviet Res. In Radiol. 29 Nov. 1963 p 7–11 refs (See N64-12886 04-16) OTS: $0.50

Three experiments were performed in which a comparison was made of the effectiveness of cysteamine ascorbate as a shielding agent in animals given primary and secondary irradiation. The experiments confirmed an assumption that an irradiated organism which received an injection of a shielding agent is less protected from subsequent irradiation than an organism which received the shielding agent prior to irradiation.

C.L.W.

N64-12895 Joint Publications Research Service, Washington, D.C.

BIOLOGICAL ACTION OF IONIZING RADIATION

G. G. Afanas'yev et al 29 Jul. 1963 11 p refs Transl. into ENGLISH of 2 articles from Dokl. Akad. Nauk SSSR (Moscow), v. 148, no. 5, 11 Feb. 1963 p 1199–1201 and 1207–1209 (JPRS-20375; OTS-63-31393) OTS: $0.50

CONTENTS:

1. SENSITIZATION OF TUMOR CELLS TO THE ACTION OF IONIZING RADIATION BY RADICAL-REACTION INHIBITORS G. G. Afanas'yev, L. P. Lipchina, and I. I. Pelevina p 1–4 refs (See N64-12896 04-16)

2. REACTION OF IRRADIATED PROTEIN RADICALS WITH ALKYLPHENOLS I. I. Sapezhinskiy, M. S. Postnikeva, and N. M. Emanuel' p 5–9 refs (See N64-12897 04-16)

N64-12896 Joint Publications Research Service, Washington, D.C.

SENSITIZATION OF TUMOR CELLS TO THE ACTION OF IONIZING RADIATION BY RADICAL-REACTION INHIBITORS

G. G. Afanas'yev, L. P. Lipchina, and I. I. Pelevina *In its* Biol. Action of Ionizing Radiation 29 Jul. 1963 p 1–4 refs (See N64-12895 04-16) OTS: $0.50

The stable free radicals formed from inhibitors have a radiomimetic action; at the same inhibitor concentrations, this radiomimetic effect appears only in tumor cells, whereas normal cells remain intact. Experimental results indicate that the joint action of free-radical reaction inhibitors and gamma rays, on cells of Ehrlich's ascitic cancer, produces an effect considerably greater than the sum of their individual effects. Radical reaction inhibitors can therefore be used to increase the sensitivity of tumor cells to ionizing radiation.

R.T.K.

N64-12897 Joint Publications Research Service, Washington, D.C.

REACTION OF IRRADIATED PROTEIN RADICALS WITH ALKYLPHENOLS

I. I. Sapezhinskiy, M. S. Postnikeva, and N. M. Emanuel' *In its* Biol. Action of Ionizing Radiation 29 Jul. 1963 p 5–9 refs (See N64-12895 04-16) OTS: $0.50

An investigation was made to elucidate the basic possibility of reactions between irradiated protein radicals R· or RO_2· (in the presence of oxygen) and free radical reaction inhibitors InH. A method was developed which makes possible the study of the reaction between previously irradiated protein radicals and various substances by the EPR (electron paramagnetic resonance) method. The EPR spectrum of ionol after reaction with protein radicals and the EPR spectrum of the ionol radical produced during reaction with lead tetraacetate were obtained. Ionol, a free radical reaction inhibitor, was found to react efficiently with irradiated protein radicals. R.T.K.

N64-12898 California U., Los Angeles School of Medicine
INCREASED ENVIRONMENTAL RADIATION IN SOUTHERN NEVADA, OCTOBER-DECEMBER, 1961
William E. Martin and Frederick B. Turner Jul. 1963 46 p refs (Contract AT (04-1)-Gen-12)
(UCLA-518)

Some of the conclusions from radiochemical and statistical analyses of samples are: (1) The gross beta activity of soils in southern Nevada tended to decrease with increasing distance from the Nevada Test Site and appeared to be related to the general pattern of fallout from nuclear detonations during the 1950's. (2) The gross beta activity of plant samples also tended to decrease with increasing distance from the Nevada Test Site. (3) There was a significant and geographically uniform increase in the beta activity of plants and rabbit stomach contents both at and to the south of the Nevada Test Site. (4) Similarly, there were increases in the radiostrontium content of rabbit bones and in the Cs-137 content of rabbit muscle. (5) Most of the observed increase of environmental radiation in southern Nevada was due to radioisotopes such as Sr-89, Y-91, Ce-141, and Ce-144 having intermediate half-lives. Author

N64-12899* Library of Congress, Washington, D.C.
ABSTRACTS OF CURRENT LITERATURE
Arnold J. Jacobius and Roman Kenk, ed. Repr. from Aerospace Med., v. 34, no. 9, Sep. 1963 p 865–876 refs
(Supported by NASA)

Abstracts of current literature dealing with aerospace medicine are presented. The abstracts are listed according to the following categories: general aspects; biology; general physiology; neurophysiology and sensory physiology; psychology and psychiatry; personnel; medical problems and pharmacology; toxicology; safety, survival, and rescue; and man-machine integration and life-support systems. P.V.E.

N64-12908 Atomic Energy Commission, New York, N. Y. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Sep.-1 Dec. 1962
Edward P. Hardy, Jr., Joseph Rivera, and William R. Collins, Jr. Jan. 1963 262 p refs
(HASL-132) OTS: $3.50

This report presents current data from the HASL Fallout Program, the U. S. Naval Research Laboratory, the New Zealand Department of Scientific and Industrial Research, and the Dominion X-Ray and Radium Laboratory in New Zealand. Radionuclide levels in fallout, milk, tap water, and upper air samples are given in tabular form. Interpretive reports and notes dealing with strontium-90 and stable strontium levels in diet and human bone, fallout at a single gummed film station, strontium-90 in 1961 wheat, cesium-137 to strontium-90 ratios in fallout, and the calculated residence times for cadmium-109 tracer are included. A bibliography of recent literature pertinent to fallout studies is given at the end of the report. Author

N64-12909 Atomic Energy Commission, New York, N.Y. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Dec. 1962-1 Mar. 1963
Edward P. Hardy, Jr., Joseph Rivera, and William R. Collins, Jr. 1 Apr. 1963 316 p refs
(HASL-135) OTS: $4.00

This report presents current data from the HASL Fallout Program, the U.S. Naval Research Laboratory, the New Zealand Department of Scientific and Industrial Research, and the Dominion X-ray and Radium Laboratory in New Zealand. Radionuclide levels in fallout, milk, tap water, and upper air samples are given in tabular form. Interpretive reports and notes dealing with worldwide strontium-90 fallout through May 1962, latitudinal spread of 1961 U.S.S.R. nuclear debris, strontium-90 levels in infant and adult diet and bone, and a comparison between two monthly fallout collection devices are included. Author

N64-12915* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RESULTS OF THE PROJECT MERCURY BALLISTIC AND ORBITAL CHIMPANZEE FLIGHTS
James P. Henry and John D. Mosely, eds. Washington, NASA, 1963 77 p refs
(NASA SP-39) GPO: $0.45

The objectives of the MR-2 and MA-5 flights were: (1) provision of animal verification of a successful spaceflight prior to manned flight; (2) provision of data on the physical and psychological demands which were to be encountered by the astronauts during spaceflight; (3) provision of a dynamic test of operational procedures and training of support personnel in handling the biomedical program for manned flight; and (4) evaluation of the spacecraft environmental control system and bioinstrumentation under flight conditions. The methods, results, and conclusions drawn as a result of these two flights are presented. J.E.T.

N64-12943* St. Louis U., Mo.
EFFECTS OF X-IRRADIATION DURING HIBERNATION ON TISSUE CATECHOLAMINE CONTENTS
X. J. Musacchia, M. Jellinek, and T. Cooper Repr. from Experienta (Basel), v. 19, no. 418, 1963 5 p refs
(NASA Grant NsG-271-62)

Hibernating *Citellus tridecemlineatus* showed a lowering of the catecholamine concentration in the liver and kidneys 20 hours after irradiation with lethal doses (2000 r). However, the content of myocardial catecholamine appeared unchanged when the changes in the water content of the tissues were considered. I.v.L.

N64-12944* Florida State U., Tallahassee Inst. for Biosciences
AMINO ACID COMPOSITIONS OF PROTEINOIDS
Sidney W. Fox, Kaoru Harada, Kenneth R. Woods, and Charles Ray Windsor (Cornell U.) Repr. from Arch. Biochem. Biophys., v. 102, 1963 p 439–445
(NASA Grant NsG-173-62)
(*Its* Contrib. 8)

Proteinoids prepared by thermal copolymerization of 18 common amino acids have been analyzed. Conditions for quantitative recovery of the total amino acids following hydrolysis

have been established. The effects of various amino acid reaction mixtures upon the composition of the polymers obtained have been studied. Author

N64-12962* National Aeronautics and Space Administration, Washington, D.C.
FORMATION OF CONDITIONED REFLEX RESPONSES TO A MAGNETIC FIELD IN FISH [OBRAZOVANIYE USLOVNYKH REFLEKSOV NA MAGNITNOYE POLE U RYB]
Yu. A. Kholodov Jan. 1964 15 p refs Transl. into ENGLISH from Tr. Soveshch. po Fiz. ryb, Akad. Nauk, SSSR no. 8, 1958 p 82–89
(NASA TT F-190) OTS: $0.50

In experiments performed on carp, the possibility of forming reflexes or inhibitions with respect to a magnetic field was established. The threshold of perception of a magnetic field was from 10 to 30 oersteds. Neither denervation of the lateral-line organs nor removal of the eyes disturbed the conditioned response. Author

N64-12967 California U., Los Angeles Brain Research Inst.
SECOND ANNUAL REPORT, JULY 1, 1962–JUNE 30, 1963
[1963] 119 p refs

A report is presented concerning the activities of the Brain Research Institute. A list of the members of the Institute is given, and the Institute's activities, service, facilities, and operational support are discussed. C.L.W.

N64-12968 California U., Davis
RADIATION TECHNOLOGY IN CONJUNCTION WITH POST-HARVEST PROCEDURES AS A MEANS OF EXTENDING THE SHELF LIFE OF FRUITS AND VEGETABLES Annual Report, 1 Feb. 1962–30 Jan. 1963
Washington, AEC Div. of Tech. Inform., 15 Oct. 1963 184 p refs
(Contract AT(11-1)-34)
(TID-19206) OTS: $2.75

The application of ionizing radiation in conjunction with postharvest procedures is discussed as a possible means of controlling deleterious pathological, physiological, and morphological phenomena in fruits and vegetables in an attempt to extend the shelf life of the fruits and vegetables. The methods employed are given along with the results which have occurred. C.L.W.

N64-12997 Army Missile Command, Huntsville, Ala.
NEW MEASURING DEVICES FOR HEALTH PHYSICS
A. Anzani, A. Malvicini, and M. Salvini 25 Oct. 1963 19 p refs Transl. into ENGLISH from Rept. 14.i, Commissione della Comunita Europa dell'Energia Atomica, Jun. 1962
(RSIC-87; AD-422785)

Reasons are summarized which led to the production of a new transistorized instrumentation for measurements in health physics. The operational principles of the circuits and the technical data obtained from the new instruments are also outlined. Author

N64-13004 California U., Los Angeles School of Medicine
SUSPENSIONS OF RADIOALBUMIN AGGREGATES FOR PHOTOSCANNING THE LIVER, SPLEEN, LUNG, AND OTHER ORGANS
G. V. Taplin, E. K. Dore, and D. E. Johnson Nov. 1963 40 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-519)

Current methods of preparing small- and large-size suspensions of radioalbumin aggregates by heat treatment and pH adjustment are presented. The small-size suspensions (10 to 20 mμ) are shown to be superior to other agents for liver–spleen scanning. Radiation exposure to these organs is minimized, and the albumin suspensions can be prepared with relative ease and simplicity. Also the heart, stomach, and salivary glands may be clearly visualized by photoscanning with this material. The techniques and physiological basis for performing and interpretating scans of these organs are described. Their diagnostic value is illustrated. The physiological basis for using large-size suspensions of the same material for visualization of the lungs is presented along with typical scans in dogs produced with suspensions of each of two size ranges (2.5μ and 15μ). The smaller size is preferable because of far less probability of capillary embolization. Author

N64-13006 Joint Publications Research Service, Washington, D.C.
THE EFFECT OF CESIUM CONCENTRATION ON ITS ACCUMULATION IN PLANTS
A. A. Titiyanova 8 Jan. 1964 6 p refs Transl. into ENGLISH of an article from Dokl. Akad. Nauk SSSR (Moscow), v. 152, no. 2, 1963 p 441–442
(JPRS-22656; OTS-64-21238) OTS: $0.50

The absorption of cesium by pea plants (Capital variety) and wheat (Erythrosperium variety) from a feed solution and from the soil was investigated. Cesium was taken in the form of CsCl with the addition of a constant quantity of radioactive Cs^{137}. Serving as a feed solution was a Knop mixture to which a CsCl solution of specific concentration was added. Results indicate: (1) There exists a direct proportional relationship between cesium concentration in the plants and in the solution. (2) A direct proportional relationship between the cesium concentration in the plants and in the soil is preserved in a range from 10^{-9} to 10^{-10} gram-equivalent weights of cesium per kilogram of soil. Beginning with the latter concentration, the relative cesium absorption in plants increases. I.v.L

N64-13007 Joint Publications Research Service, Washington, D.C.
BIOGEOCHEMISTRY OF SULFUR
S. I. Kuznetsov 9 Jan. 1964 20 p refs Transl. into ENGLISH of an article from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 5, 1963 p 668–680
(JPRS-22672; OTS-64-21249) OTS: $0.50

A schematic survey of the main concepts of V. I. Vernadskiy on the biochemistry of sulfur in the lithosphere is presented, and his idea on the biogenic oxidation of hydrogen sulfide to sulfur and sulfates is confirmed. In addition, the biogenic reduction of sulfates to hydrogen sulfide in petroleum deposits and the oxidation of copper sulfides in carbon and ore deposits, as a result of the activity of *Thiobacillus thiooxidens*, are discussed. I.v.L

N64-13017 Public Health Service, Washington, D.C.
SMOKING AND HEALTH
Stanhope Bayne-Jones et al 403 p refs Rept. of the Advisory Comm. to the Surgeon Gen.
(*Its* Publ. no. 113) GPO: $1.25

A detailed investigation was conducted to determine the relationships and the effect of smoking on the health of the human body. Thorough qualitative and quantitative analyses were conducted on tobacco, and numerous substances were isolated and studied to determine the possible roles they play

in reference to health. The complete metabolic cycle of nicotine in the mammalian body was given, and statistical analyses were made of the mortality rates of both smokers and nonsmokers. Correlation of the data discovered in the investigation established a definite link between smoking and cancer of the lungs and heart diseases. C.L.W.

N64-13078 School of Aerospace Medicine, Brooks AFB, Tex.
LATENT EFFECTS OF CHRONIC IRRADIATION ON LONGEVITY AND THE PERIPHERAL BLOOD ELEMENTS OF THE MONKEY, MACACA MULATTA
Donald R. Anderson Sep. 1963 9 p refs
(SAM-TDR-63-55; AD-423076)

One of the problem areas of radiation biology is concerned with the latent or long-term effects of the biologic damage that might result from chronic low dose levels of ionizing radiation. This report presents data from a study in the primate, *Macaca mulatta*, over a period of several years following a chronic irradiation schedule resulting in accumulated doses of 77 to 614 rep of mixed gamma and neutron radiations. Although the circulating blood elements are considered to be sensitive to radiation damage, they recovered, following the irradiation schedule, to essentially normal condition and showed no long-term decrement due to the radiation exposure. Longevity in the limited number of animals utilized also indicated no change due to radiation. Author

N64-13085 Joint Publications Research Service, Washington, D.C.
THE PRESENT AND FUTURE USES OF CYBERNETICS IN MEDICINE
Yu. Frolov 8 Jan. 1964 7 p ref Transl. into ENGLISH of an article from Med. Rabotnik (Moscow), 16 Aug. 1963 p 3
(JPRS-22647; OTS-64-21230) OTS: $0.50

A discussion is presented of the significance and role of cybernetics in the development of medical sciences and its usefulness in medical practice. R.T.K.

N64-13086 Joint Publications Research Service, Washington, D.C.
ON THE POSSIBILITY OF DIVISION OF CORTICAL NEURONS
R. V. Ivannikova 10 Jan. 1964 7 p refs Transl. into ENGLISH of an article from Byull. Eksptl. Biol. i Med. (Moscow), v. 55, no. 1, Jan. 1963 p 93–95
(JPRS-22690; OTS-64-21258) OTS $0.50

An investigation to determine whether a histological regeneration of cortical neurons takes place during functional restoration following a bilateral extirpation of the occipital lobe, or whether the anatomical restoration proceeded only at the expense of the displacement of adjacent cortical elements into the area of the defect is discussed. From the results it can be assumed that the deciding importance in the restoration of functions can be attributed to the cortex (possibly together with the subcortex) which has been preserved after the operation and which anatomically filled out the defect. The presence of mitoses and amitoses in the neural cells during early stages following the operation and their absence during the period of scar formation attest to the fact that regeneration of the neurons is possible in principle, but that it requires special conditions for its manifestation, and these conditions are ones that would inhibit formation of the scar tissue. P.V.E.

N64-13106 George Washington U., Washington, D.C. Human Resources Research Office
VIGILANCE: A GUIDE TO IMPROVED PERFORMANCE
Bruce O. Bergum Oct. 1963 39 p refs
(Sponsored by Army)
(HumRRO Res. Bull. 10)

The vigilance effect is defined as a systematic decrease in the probability of perceiving a given stimulus over a period of time, a systematic loss in attention. This report is a summary of the research that has been done to: (1) determine the full range of conditions that affect vigilance behavior, such as characteristics of the task and of the environment, differences among individuals, and motivational factors; and (2) describe how variations in these conditions are related to variations in detection responses. R.T.K.

N64-13133 California U., San Francisco School of Medicine
RADIOLOGICAL LABORATORY Annual Progress Report for Period ending September 30, 1963
Robert S. Stone, and Gail D. Adams Nov. 1963 58 p refs
(Contract AT(11-1)-GEN-10)
(UCSF-23) OTS: $1.50

The program is divided into three major fields: (1) clinical radiology; (2) radiation physics; and (3) radiation biology. Research was conducted in the following areas: (1) cancer therapy with 70 Mv X-rays—gross survival, carcinoma of the urinary bladder, carcinoma of the cervix uteri, intracranial tumors, and reaction to radiation; (2) synchrotron operation; (3) dosimetry; (4) EEG changes after low-level X-irradiation (dog brain); (5) data processing; (6) influence of magnetic fields on biological systems; (7) somatic effects of X-rays—survival in Chinese hamster, and mouse kidney and intercapillary glomerulosclerosis; (8) radiation genetics—studies of progeny of irradiated male mice and studies relating to histocompatibility loci in mice. R.T.K.

N64-13139 Yale U., New Haven, Conn. School of Medicine
THE ROLE OF ARGON METASTABLE ATOMS IN THE IONIZATION OF ORGANIC MOLECULES
M. M. Shahin and S. R. Lipsky Repr. from Anal. Chem., v. 35, Oct. 1963 p 1562–1566 refs
(NASA Grant NsG-192-61)

A microionization chamber of coaxial design, previously described as a detection system for gas chromatography, has been used to investigate the mechanisms by which argon carrier gas provides high sensitivities to organic molecules with ionization potential below 11.6 ev. It is shown that for vapor concentrations (ethylene) up to 3 to 4 pp 10^4 in the carrier gas the Penning Effect is the sole reaction mechanism for the response of the detector. Beyond this concentration, the collisions of the secondary electrons with sample molecules become important, and the response is either increased or decreased depending on the ionization potential of the test molecule and the field strength which determines the electron energy. The decrease is affected by quenching of the electron energy, while the increase is brought about by ion multiplication of the test molecule. Author

N64-13149 Naval Medical Research Inst., Bethesda, Md.
ANIMAL CALORIMETRY: ITS FUTURE
T. H. Benzinger Repr. from Trans. Am. Soc. Agr. Eng., v. 6, no. 2, 1963 p 119–122 refs Presented at the Ann. Meeting of ASAE, Washington, D.C., June 1962
(NASA Order R-38)
(ASAE Paper 62-422)

The future of animal calorimetry is reviewed. It is quite possible that the secrets of excessive leanness or obesity, the secrets of efficient or poor utilization of food lie in the coupling or uncoupling of oxidative phosphorylation. The measurement of oxygen consumed and calorimetry of heat evolved should be an important key to new knowledge of these relations. A tendency of tissues toward excessive breakdown, or toward excessive synthesis, may in turn be the primary cause for high consumption of oxygen and food. Thus, increased food intake may be a consequence, more than a cause, of obesity. Calorimetric studies on metabolic breakdown and synthetic activities may shed light on the chemical compounds which produce, or the absence of which, produces the chemical sensations on which the intake of food depends. In addition, calorimetry may prove useful in studying the phenomenon of thermal homeostasis in farm animals. Perhaps minute deviations from normality in warm animals. Perhaps minute deviations from normality in warmth or cold may be important, and they may influence the productivity of animals for milk or eggs or meat. I.v.L.

N64-13161 Joint Publications Research Service, Washington, D.C.

REASONS FOR THE FAILURE OF ANTIBIOTIC THERAPY OF AUTOINFECTION IN RADIATION SICKNESS

I. D. Meter 7 Jan. 1964 13 p refs Transl. into ENGLISH from Med. Radiol. (Moscow), v. 8, no. 8, Aug. 1963 p 58–65 (JPRS-22625; OTS-64-21219) OTS: $0.50

Antibiotic therapy of autoinfection in radiation sickness in X-irradiated mice was investigated. Results indicate: (1) Streptomycin is the most effective antibiotic for treating the autoinfection associated with radiation sickness. Under optimum conditions, it saves some 85% of the animals that would otherwise die (with 70% mortality in the controls). It is maximally effective in a narrow range of doses. (2) The success of antibiotic therapy varies with the time it is started. The optimum time, with the optimum dose, is between the third and fifth days after irradiation, i.e., in the period when bacteremia sets in. (3) The factors that impair the effectiveness of antibiotics for radiation autoinfection include change in the nature of the microflora in mice caused by treatment; the presence of resistant forms of bacteria and their rapid adaptation to antibiotics in the irradiated organism; and death due to nonbacterial causes (interference with hematopoiesis, etc.). (4) The combined use of streptomycin with cortisone as a detoxicating hormone is a promising method of treating radiation sickness. I.v.L.

N64-13163 Joint Publications Research Service, Washington, D.C.

COMPARATIVE RADIOSENSITIVITY OF INHERITED STRUCTURES OF CELLS OF MAMMALIA IN VITRO

L. I. Lebedeva et al 14 Jan. 1964 5 p refs Transl. into ENGLISH of an article from Dokl. Akad. Nauk SSSR (Moscow), v. 152, no. 5, 1963 p 1225–1226 (JPRS-22719; OTS-64-21280) OTS: $0.50

The radiation sensitivity of the chromosomes of the embryonic fibroblasts of guinea pigs and mice of the line CC 57 BR was investigated. Fresh cultures of the fibroblasts of one to one-and-a-half-month-old guinea pig embryos and 15- to 17-day old mouse embryos. Serving as a criterion for evaluating the degree of radiation sensitivity of the nuclear structures was the percentage of cells with chromosome rearrangement observed in the anaphases and telophases. The radiation doses were 10 and 50 r for the guinea pig and 50 r for the mouse. Results indicate that the chromosomes in cells *in vitro* taken from more radiation-resistant animals prove to be more radiation-resistant than the chromosomes in the cells of radiation-sensitive animals. I.v.L.

N64-13165 Los Alamos Scientific Lab., N. Mex.

RADIATION HAZARD RESULTING FROM TRITIUM DIFFUSION IN GLOVE BOX OPERATIONS

George N. Krebs, Jr., 10 Dec. 1963 15 p refs (Contract W-7405-eng-36) (LMS-2962) OTS: $0.50

Tritium exposure to personnel handling tritium compounds in glove boxes can be significantly reduced by the wearing of surgeon's gloves while working in the dry-box gloves. To investigate this reduction quantitatively and to determine criteria for the frequency of glove change, mathematical analyses of the diffusion of HTO through dry-box rubber gloves with and without surgeon's gloves are made. The relative amounts of HTO absorbed by the worker as a function of time in the two cases are then compared. For tritium concentrations of one curie per cubic meter in the glove-box atmosphere, a change of surgeon's gloves every 15 to 20 minutes is recommended as a safe working procedure. Author

N64-13168* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYNTHESIS OF ADENOSINE TRIPHOSPHATE UNDER POSSIBLE PRIMITIVE EARTH CONDITIONS

Cyril Ponnamperuma, Carl Sagan (Harvard U.), and Ruth Mariner Repr. from Nature (London), v. 199, no. 4890, 20 Jul. 1963 p 222–226 (NASA RP-94)

Materials and the experimental techniques are given which were used in the synthesis of adenosine triphosphate. Four categories of experiments were performed. In the first the starting material was adenine, in the second adenosine, in the third to adenosine monophosphate, and in the fourth adenosine diphosphate. The conversion of adenine to adenosine, adenosine to monophosphate, adenosine monophosphate to adenosine diphosphate, and adenosine diphosphate to adenosine triphosphate has been established. C.L.W.

N64-13186* Naval School of Aviation Medicine, Pensacola, Fla. Naval Aviation Medical Center

THE DECEMBER 1962 REPORT OF THE RBE COMMITTEE TO THE ICRP AND ICRU IN ITS IMPLICATIONS FOR THE ASSESSMENT OF PROTON RADIATION EXPOSURE IN SPACE Research Report

Hermann J. Schaefer 18 Oct. 1963 16 p refs Joint Report–NASA and Naval School of Aviation Med. (NASA Order R-75) (NASA CR-55189; Bur. Med. and Surgery 26) OTS: $1.60 ph, $0.80 mf

Some of the implications of new rules set forth in the report named in the title concerning exposure to proton radiations in space are discussed. The proposed formulae assigning precise values of relative biological effectiveness (RBE) and quality factor (QF) to any given linear energy transfer (LET) are evaluated for typical spectra of X-rays, flare produced protons, and neutron recoil protons. The results essentially reconfirm earlier assessments. Since the report reemphasizes the basic difference between low LET and high LET radiation with regard to residual damage from low dose rate exposures, it seems advisable that dosimetric instrumentation for manned space operations provides ways and means for separate measurement of the two fractions of exposures to proton beams. Author

N64-13199* Martin Co., Baltimore, Md. RIAS
PHOTOSYNTHETIC ELECTRON TRANSPORT
Bessel Kok Repr. from "Photosynthesis Mech. in Green Plants", Nat. Acad. Sci. -Nat. Res. Council, Publ., no. 1145, 1963 p 35–44 refs
(NASA Contract NASw-747)

The first photoreaction of photosynthesis mediated by the long-wave pigment P700; the photoreduction and photooxidation of indophenol dye, site of phosphorylation; and the photooxidation of cytochromes and plastocyanin by detergent-treated chloroplasts were investigated. The results in the same sequential order are: (1) P700 is the photoconverter of photosystem I in photosynthesis. (2) DCPIP is reduced at the same locus as TPN by the primary reductant X^- made in the first photoact. Thus, in the absence of the second photoact (DCMU or long wave light) indophenol dye mediates a vigorous cyclic electron transport. (3) The kinetics of plastocyanin photooxidation do not necessarily differ from those of cytochrome f oxidation. This suggests that not only cytochrome f but also plastocyanin has a fixed locus in the chloroplast matrix and can operate in a complex with P700. I.v.L.

N64-13204* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE EARLY ONSET OF THYMINELESS DEATH OCCURRING AFTER EXPOSURE TO ULTRAVIOLET LIGHT
Ronald E. Rasmussen and Robert B. Painter Repr. from Biochim. Biophys. Acta, v. 76 1963 p 157–159
(PN-6117)

Gallant and Suskind have presented data indicating that death due to lack of thiamine and irradiation with ultraviolet light act on the same sites in *Escherichia coli* strain B-3. This report confirms their observations and shows additional features of the cooperative action of ultraviolet light and the lack of thiamine in this bacterial strain. Results of the present investigation indicate: (1) Early loss of viability is still apparent if the ultraviolet-light-irradiated organisms are subjected to photoreactivation, but the slope of this loss is about one-half of that of organisms held in the dark room. (2) Ultraviolet-light lesions, contributing to the early onset of thiamineless death, may be partially photoreactivated. (3) A comparison of the curves of photoreactivated cultures with those of nonphotoreactivated cultures showed that early death may be reversed by either photoreactivation or the presence of thiamine; however, later death can be prevented only by thiamine, and the lag before onset is unaffected by photoreactivation. I.v.L.

N64-13229 Joint Publications Research Service, Washington, D.C.
VARIATIONS OF RNA IN GIANT CHROMOSOMES OF *CHIRONOMUS DORSALIS* DURING METAMORPHOSIS AND EXPERIMENTAL EFFECTS
I. I. Kikhadze and I. T. Filatova 9 Jan. 1964 9 p refs Transl. into ENGLISH of an article from Dokl. Akad. Nauk SSSR, (Moscow), v. 152, no. 2, 1963 p 450–453
(JPRS-22666; OTS-64-21245) OTS: $0.50

A regular variation in the function of the RNA synthesizing section of the giant chromosomes of *Chironomus dorsalis* was found to take place during the course of metamorphosis. Under the influence of TA (thioacetamide), the activity of RNA production by chromosomes was found to vary. The chromosomes showed varying sensitivity to TA at different stages of metamorphosis. The selective influence of TA on individual chromosomes and their sections was established. R.T.K.

N64-13230 Joint Publications Research Service, Washington, D.C.
CYTOLOGICAL ANALYSIS OF THE RADIOSENSITIVITY OF SIMILAR TISSUES IN DIFFERENT SPECIES OF MAMMALS
G. A. Chudinovskaya and O. N. Kitayeva 16 Jan. 1964 15 p refs Transl. into ENGLISH of an article from Zh. Obshch. Biol. (Moscow), v. 24, no. 6, 1963 p 435–444
(JPRS-22778; OTS-64-21316) OTS: $0.50

A cytological analysis was made of the radiosensitivity of bone marrow and lymph node cells in irradiated mice, rats, golden hamsters, and guinea pigs. Results indicate: (1) The general nature of the changes in mitotic activity of bone marrow and lymph node cells is the same in irradiated mice, rats, golden hamsters, and guinea pigs. There is a sharp drop in the mitotic index in these animals the first 1 1/2 to 2 hours after exposure to 100 r of irradiation. Mitotic activity increased within 2 to 3 hours after exposure, sometimes exceeding the level of the nonirradiated control (supercompensation). Mitotic activity was more or less normal after 144 hours (end of investigation). (2) The degree of supercompensation was less than that of the initial depression with a single, whole-body exposure to 100 r. This may be due to partial destruction of cells in the tissues of the irradiated animals. (3) The animals can be listed as follows, judging by the decrease in mitotic activity noted 2 to 3 days after whole-body irradiation (100 r):

bone marrow—mouse > rat > golden > guinea pig; lymph nodes—mouse > rat > golden > guinea pig > hamster.

I.v.L.

N64-13305 Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE BIOLOGY OF SPACE FLIGHT: AN ANNOTATED BIBLIOGRAPHY [1958-1962]
Charlie M. Pierce, comp. Apr. 1963 317 p refs
(Contract AF 04(695)-136)
(Special Bibl. SB-63-20; Rept. 8-55-63-2; AD-425912)

The topics included are food provisions, atmosphere control, waste control and water recovery, emergency survival systems, psychology, radiation and meteoroids, gravitation, magnetic fields, and exobiology. Author

N64-13320 Joint Publications Research Service, Washington, D.C.
INTERNATIONAL CONFERENCE ON THE DIAGNOSIS AND TREATMENT OF CONTAMINATION BY RADIOACTIVE ISOTOPES, VIENNA, 15-18 OCTOBER 1962
Yu. I. Moskalev 3 Jan. 1964 28 p Transl. into ENGLISH of an article from Med. Radiol. (Moscow), v. 8, no. 8, Aug. 1963 p 77–78
(JPRS-22610; OTS-64-21214) OTS: $0.75

Reports were presented that included: (1) methods of detecting radioactive substances in the body of man, both by measuring the external γ radiation as well as by means of determining the activity in secretions; (2) experimental investigations of the distribution and kinetics of removal of radioactive isotopes, on the effect of complexing agents and a number of other preparations in removing them from the organism and the magnitude of absorption from the gastrointestinal tract; (3) results of clinical observations on the distribution of Sr^{90}, Cs^{137}, Ra^{226}, Pu^{239}, and mixtures of fission products in the body of man, on speeding up their removal from the organism, and of the diagnosis and therapy of several conditions caused by the striking of radioactive isotopes on the skin and inside the organism. R.T.K.

N64-13329 Atomic Energy Commission, New York, N.Y. Health and Safety Lab.
FALLOUT PROGRAM QUARTERLY SUMMARY REPORT, SEPTEMBER 1, 1963-DECEMBER 1, 1963
Edward P. Hardy, Jr., Joseph Rivera, and William R. Collins, Jr. 1 Jan. 1964 244 p refs
(HASL-142) OTS: $4.00

Radionuclide levels in fallout, milk, tap water, diet, and upper air samples are given in tabular form. Also included are interpretive reports and notes dealing with fission product concentrations in the upper atmosphere, cumulative strontium-90 deposition levels from analyses of soils collected in 1962, and measurements of cesium-137 in the 1962 wheat crop.
Author

N64-13337 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
A THEORETICAL INVESTIGATION INTO THE CIRCULATION NEEDED TO CONTROL THE CARBON DIOXIDE CONCENTRATION IN A SPACE CAPSULE CABIN
G. F. Rowlands and K. R. Maslen Aug. 1963 23 p refs
(RAE-TM-ME-273)

The minimum ratio of purifying circulation flow to breathing flow needed to obtain an acceptable CO_2 concentration in the breathing atmosphere of a space capsule has been calculated. Equations have been derived for the main gas constituents and for the three possible systems, namely, open circuit (no mask), part-closed circuit (mask with either the inhalation or exhalation port open to the cabin, the other piped through the purification circuit), and closed circuit (mask with both inhalate and exhalate piped into the purification circuit). The equations give the time constant of the extraction process and the steady-state conditions achieved.
Author

N64-13344 Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE DEVELOPMENT OF A CONTINUOUS CELL LINE FROM NORMAL DOG LIVER AND ITS SUSCEPTIBILITY TO VIRUSES Technical Progress Report
Frank F. Pindak and William E. Clapper Aug. 1963 26 p refs
(Contract AT(29-2)1013)
(LF-10) OTS $0.50

A continuous line of cells was developed from a primary culture of new-born dog liver. The cells were inoculated with five types of Coxsackie B virus, three types of poliovirus, nine types of ECHO virus, and six miscellaneous viruses. Nineteen of these produced cytopathic effect without need of adaptation to the cells. One virus became adapted after four passages, one lost its ability to destroy the cells after the first passage, and two failed to grow even after several blind passages.
Author

N64-13350 Joint Publications Research Service, Washington, D.C.
ULTRASONICS – PHYSICOCHEMICAL AND BIOLOGICAL ACTION
I. Ye. El'piner 21 Jan. 1964 37 p refs Transl. into ENGLISH of the Table of Contents and Chapt. 11 from the book "Ul'trazvuk—Fiziko-Khimicheskoye Biologicheskoye Deystviye", Moscow, 1963 p 3-4 and 381-411
(JPRS-22840; OTS-64-21356) OTS: $1.00

Data are presented that demonstrate how modern ultrasonic techniques can be used successfully to study the macrostructure of organs and tissues, and in clinical practice for their visualization. The successful development of methods for determining the acoustic parameters of various media has led to new possibilities in the study of the structural characteristics of biological liquids, cells, and tissues. A table is included that gives the absorption coefficient and depth of penetration for water and the following tissues at an ultrasonic frequency equal to 1 megacycle per second: blood plasma, blood, skeletal muscles, liver, kidneys, and adipose tissue.
R.T.K.

N64-13353 Joint Publications Research Service, Washington, D.C.
THE SUBJECT AND METHODS OF MODERN BIOPHYSICS
Yu. N. Polyanskiy 21 Jan. 1964 9 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), v. 17, no. 6 p 155–158
(JPRS-22830; OTS-64-21349) OTS: $0.50

This report of a conference presents a discussion of modern biophysics. An attempt is made to give a definitive statement of what the science of biophysics includes, and what methods are to be used in biophysical investigation. Opinions of conference participants and discussions of their remarks are given.
E.W.

N64-13370* Martin Co., Baltimore, Md. RIAS Div.
PHOTOREACTIONS AND RESPIRATION
George Hock and Olga V. H. Owens Repr. from "Photosynthesis Mech. in Green Plants", Nat. Acad. Sci.–Nat. Res. Council, Publ., no. 1145, 1963 p 409–420 refs
(Sponsored by NASA)

The determination of the relationship between oxidation (as evidenced by respiration) and light utilization was investigated. Results indicate that respiratory changes can and do cause many anomalies when the net rate of gas exchange is taken as a measure of photosynthesis. A remarkable linearity of actual oxygen production, as a function of light intensity, over the lower intensity regions was observed. These respiratory effects are clearly the source of many discrepancies in the measurement of the quantum yield of photosynthesis as a function of wavelength. The effects also provide an explanation for the puzzling phenomenon of negative enhancement. It appears that photosynthesis and respiration are not mutually exclusive processes within the cell but are interrelated, allowing the cell to function as an entity.
I.v.L.

N64-13376 Joint Publications Research Service, Washington, D.C.
ELECTROMYOGRAPHY OF HUMAN SKELETAL MUSCLE TONE IN THE NORMAL AND PATHOLOGICAL STATE
Yudif' Samoylovna Yusevich 17 Jan. 1964 29 p Transl. into ENGLISH of the Conclusion and Table of Contents from the book "Elektromiografiya tonusa skeletnoy muskulatury cheloveka v norme i patologii" Moscow, Medgiz, 1963 p 109–129 and 162
(JPRS-22782; OTS-64-21319) OTS: $0.75

The following topics are discussed: (1) basic principles of muscular electrogenesis during tonic reactions in the normal and pathological state; (2) clinical significance of electromyographic examinations of muscle tone; and (3) the role of electromyographic examinations in the neurophysiology of human muscle tone.
R.T.K.

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems.

N64-12449 Joint Publications Research Service, Washington, D.C.
ZONE REFINING OF NIOBIUM BY THE ELECTRIC-ARC METHOD
A. I. Yevstyukhin, V. V. Nikishanov, and I. V. Milov *In its* Studies in Casting, Production, and Refining of High-Temp. Alloys 19 Dec. 1963 p 23–34 refs (See N64-12445 04-01) OTS: $1.00

Experiments to determine the advantages and disadvantages of the arc zone method for the refinement of niobium are reported. The advantages include control of the width of the fused zone using a water-cooled copper crucible for heat withdrawal, simplicity, and the possibility of large-scale operation. The difficulty encountered using this method was the stable delivery of power for the low-voltage arc discharge, which assumes great importance at low rates of motion of the zone. Samples of commercial grade molybdenum were subjected to from 16 to 128 passages of the zone at a rate of 0.5 mm/sec. Some refinement from lead and carbon was detected at this rate of motion of the zone, but the limit of refinement was not reached at 128 passages. A rate five to ten times smaller than the rate used in this study is recommended for the successful refinement of niobium by the arc zone method. M.P.G.

N64-12630 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FASTENING OF RUBBER TO METAL WITH THE AID OF THE PRODUCTS OF OXIDATION OF RUBBER
B. A. Dogadkin and A. D. Poyarkova 16 Oct. 1963 13 p refs Transl. into ENGLISH of an article from Kauchuk i Rezina (Moscow), no. 2, 1963
(FTD-TT-63-831/1+2; AD-425514)

Analytical and spectral data were used to prepare oxygen-containing groups in a method which was used to fasten rubber to metal with the aid of oxidation products of nitrogen-butadiene rubber (adhesive). Satisfactory results were obtained in fastening to steel, zinc, and brass. A graphical analysis of the adhesive film strength is included. J.E.T.

N64-12640 Republic Aviation Corp., Farmingdale, N.Y.
ELECTRO-SPARK EXTRUDING Interim Technical Progress Report No. 1, 1 Jul.–1 Oct. 1963
G. Pfanner and J. H. Wagner Oct. 1963 22 p
(Contract AF 33(657)-11265)
(RAC-1776; ASD-TR-111(I); AD-420415)

Literature survey in capacitor discharge extrusion and dynamic effects of shock loading has been completed. A stress analysis considering the effect of explosive shock type loadings is nearing completion The objective of the program is to extrude steel to 1/4in. rounds by the use of capacitor discharge energy. Pressure chamber requirements are that the vessel must hold a hydrostatic pressure of 200,000 psi and be capable of containing shock energy from a 155,000 joule capacitor discharge. Author

N64-12702 Joint Publications Research Service, Washington, D.C.
SOME FEATURES OF WELDING NIOBIUM AND ITS ALLOYS
D. S. Balkovets and L. N. Kaganov 3 Jan. 1964 12 p refs Transl. into ENGLISH from Svarochnoye Proizvodstvo (Moscow), no. 10, Oct. 1963 p 10–12
(JPRS-22597; OTS-64-21205) OTS: $0.50

The results of some investigations on argon arc, spot, and roller welding of niobium alloys and the properties of the welded joints obtained are cited. It was found that a considerable gas content in niobium alloys ($\geq$0.01% O_2 and $\geq$0.02% H_2) substantially lowers the plasticity of joints made by argon arc welding. Vacuum annealing before welding and especially after welding increases the plasticity of the welded joints. In the case of spot and roller welding of niobium alloys, the greatest difficulty lies in the melting of the copper electrodes because of the high melting points of these alloys. The use of screens and graphite coating of the welded parts substantially reduces the melting of the electrodes. Author

N64-12837 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MACHINABILITY OF HEAT-RESISTANT AND TITANIUM ALLOYS
V. A. Krivoukhov, S. V. Yerorov, B. Ye. Brushteyn, A. I. Markov, and A. G. Chervyakov et al 26 Sep. 1963 321 p refs Transl. into ENGLISH of book "Obrabaytovayemost' Rezaniyem Zharoprochnykh i Titanovykh Splavov" Gosudarstvennoye Nauch.-Teknicheskoye Izd. Mashionostroitel'noy Lit. Moscow, 1961 p 1–244
(FTD-TT-62-1257/1+2; AD-424380)

The results of research to determine the influence of various factors on the machinability of the alloys are presented. These include tool geometry, cutting-tip wear, cutting formulas, cooling and lubricating fluid, and heat treatment of the metals. Author

N64-12844 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW METHODS OF PRODUCING ROLLED STEEL
V. F. Isupov and V. S. Slavkin 30 Sep. 1963 20 p Transl. into ENGLISH from a Russian book, "Proizvodstvo Kalibrovannoy Stali", Moskva, Metallurgizdat 1962 p 167–184
(FTD-TT-63-716/1; AD-423605)

This report discusses attempts to improve the hot rolling, hot drawing, and grinding of calibrated steel. Also discussed are rolling mills in the U.S. which assure accurate rolling of bands with a diameter of up to 36 mm which meet the requirements prescribed for calibrated steel. I.v.L.

N64-12861 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ULTRASONICS HEIGHTENS THE STRENGTH OF PARTS
31 Oct. 1963 4 p Transl. into ENGLISH from Ekon. Gaz. (Moscow), 1 Apr. 1961 p 4
(FTD-TT-63-1001/1; AD-424876)

A new method was proposed for ultrasonic processing of parts from metals and alloys for the purpose of improving their mechanical and physical properties. This new method eliminates the losses of acoustical power, and assures the excitation of traveling waves in the parts, which results in a uniform processing of the part over its length. The essence of the method consists in processing the parts by powerful ultrasonic vibrations in such a way that the part is fastened at one end to the ultrasonic vibrator and at the other end it is dipped in a liquid medium. The method has successfully withstood experimental checking. C.L.W.

N64-12894 Joint Publications Research Service, Washington, D.C.
NEW DESIGNS FOR REDUCTION FURNACES IN THE PRODUCTION OF HARD ALLOYS
V. N. Mel'nikov, V. A. Vesnina, G. L. Fridman, and V. V. Yakovlev *In its* Develop. in USSR Powder Met. 22 Jul. 1963 p 15–29 refs (See N64-12892 04-01) OTS: $1.25

Several reduction furnace designs are given which are used in the reduction of tungsten. The majority of the designs utilize

the hydrogen reduction method but at least one of the designs utilizes the carbon reduction method. Furnace specifications and operating procedures are given for furnaces of both types.
C.L.W.

N64-12956* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRASONIC WELDING OF A BERYLLIUM WINDOW ASSEMBLY
J. A. Munford, B. R. Cantor, and A. Piltch Washington, NASA, Jan. 1964 9 p
(NASA TM X-935) OTS: $0.50

A method of fabricating thin beryllium window assemblies in rigid frames by ultrasonic welding of thin (0.001 inch) beryllium foil to AISI 310 stainless steel is described. Interleaf rings of 0.001-inch aluminum foil are used between the beryllium and stainless steel for cushioning and to reduce power requirements. Vacuum-tight joints were achieved, but metallographic examinations indicate the need for improved beryllium.
Author

N64-12979 Battelle Memorial Inst., Columbus, Ohio
RESEARCH ON SOLID-PHOSPHORUS PENTOXIDE ELECTROLYTES IN ELECTROLYSIS CELL FOR PRODUCTION OF BREATHING OXOGEN Technical Documentary Report [15 Jun. 1962-30 Jun. 1963]
John G. Beach, John Clifford, James Gates, and Charles Faust Wright-Patterson AFB, Ohio, Biomedical Lab., Oct. 1963 43 p refs
(Contract AF 33(657)-9355)
(AMRL-TDR-63-95; AD-423680)

Electrolysis of water in hydrated phosphorus pentoxide electrolytes was investigated toward the production of oxygen to satisfy the needs of three men, at 6 pounds per day. Two, 1/10-man, laboratory-model units were operated for periods totaling about 200 hours of electrolysis per unit. Equilibrium conditions of absorption and electrolysis were maintained for periods up to 79 hours. Water absorption into the phosphoric-acid electrolyte from moist air circulated to the anode passages of the units was sufficient to replace that consumed by electrolysis. A 3-man electrolysis unit is projected consisting of a battery of the 1/10-man units weighing less than 159 pounds, occupying about 1.1 ft^3, and requiring 1560 w.
Author

N64-13022 Los Alamos Scientific Lab., N. Mex.
OPERATING CHARACTERISTICS OF A FAST ELECTROMAGNETICALLY OPERATED GAS VALVE
E. A. Knapp and A. H. Williams 13 Dec. 1963 22 p refs
(Contract W-7405-eng-36)
(LA-2978) OTS: $0.50

The valve consists of a gas plenum and a thin metallic diaphragm sealing an O-ring opening that is surrounded by a one-turn coil. The diaphragm is momentarily lifted off the O-ring seat by the magnetic field produced by a fast-rising current in the one-turn coil. A 14-μF capacitor operating at 4-6 kv energizes the coil with a period of $\sim$20 μsec. The pressure of deuterium gas released by the valve was measured as a function of time and distance from the valve by a fast ion gage. The performance of two diaphragms was investigated. A circular diaphragm gave a peak pressure of 70 μ in $\sim$150 μsec at an axial distance of 30 cm with a total gas input of $\sim$1 cc atm. A circular diaphragm with a central stem produced a very sharp gas pulse, rising to 80 μ in $\sim$50 μsec 20 cm from the diaphragm. The latter diaphragm allowed gas inputs of $\sim$0.15 cc atm to be released.
Author

N64-13074 AVCO Corp., Stratford, Conn.
METASTABLE AUSTENITIC FORMING OF HIGH STRENGTH PRESSURE VESSELS Interim Technical Progress Report
J. M. Raymer 15 Apr. 1963 53 p refs
(Contract AF 33(657)-7955)
(AD-402636)

Three selected alloys—Type H-11 tool steel, AM 355 semi-austenitic stainless steel, and 18NiCoMo (300) maraging steel—were fabricated into biaxial pressure vessel test specimens. The fabricated pressure vessels (i. e., tubes) were tested to failure in a hydrostatic test facility and evaluated for selection of an optimum material and associated fabrication process for a high-performance, integral rocket motor case. An intermediate size cylindrical test specimen and an integral subscale rocket motor case were designed for investigation of optimized fabrication techniques for the manufacture of an integral motor case from 18NiCoMo (300) material.
Author

N64-13192* Michigan U., Ann Arbor College of Engineering
DEFORMATION AND STRESS IN AN INFLATED AIRCRAFT TIRE Technical Report No. 1
S. K. Clark, R. N. Dodge, J. T. Tielking, and B. Herzog Oct. 1963 64 p refs
(NASA Grant NsG-344)
(NASA CR-55174; Rept. 05608-2-T) OTS: $6.60 ph, $2.12 mf

The principle of potential energy is applied to toroidal shell problems with particular application to internal pressure in pneumatic tires. By use of this principle, the orthotropic nature of tire materials may easily be included in the equations governing the solution. Past work on the elastic characteristics of orthotropic laminates is brought together and correlated in such a way that the elastic response of a pneumatic tire to inflation pressure may be determined, provided that basic tire characteristics are known, such as, cord properties, rubber modulus, the geometry of individual plies, number of plies in the tire carcass, and the geometry of the tire. A digital computer program has been constructed which accepts the input data discussed previously and provides as output the elastic displacements of the tire in the form of the displacements of its carcass midline. From such displacements may be calculated loads in the tire cords, interply stresses between different plies of the tire, and bead forces. These cord loads and interply stresses may be calculated on a membrane basis, on a bending basis, or by utilizing both effects.
Author

N64-13198* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
DETECTIVE STORY: WHY DID A HYDROSTATIC PRESSING VESSEL FAIL?
Richard A. Terselic Repr. from Safety Maintenance, Nov. 1963 4 p refs
(NASA RP-92)

The cause of a pressing-vessel failure was investigated. A macroetch inspection uncovered the presence of small cracks, which were identified as grinding checks, after the chrome had been stripped from the inside diameter of the vessel. The cracks were found to exist in greatest numbers around a diameter which was about 4 inches below the top surface of the die. This diameter coincided with the position of the apparent failure origins. Checks were also found on the top surface of the die directly adjacent to the bore. The readily noted difference in macroappearance between the top and bottom of the section can be attributed to the way in which the failure propagated. The fine-grain structure observed in the upper portion of the die body fragment indicated the early progress of the failure.

The failure origins lay at the apex of the smooth flowing, radiating lines. The coarse structure near the bottom represented the area where the material was torn apart as the failure progressed downward. Based on these observations, it was concluded that the initiation of the failure can probably be attributed to grinding checks in an excessively hard material. However, hydrogen embrittlement may have occurred also.
I.v.L.

N64-13231 Westinghouse Electric Corp., Elkridge, Md. Molecular Electronics Div.
PRODUCTION ENGINEERING MEASURE Quarterly Report, 29 Jun.-30 Sep. 1963
Hauw T. Go [1963] 44 p
(Contract AMC-36-039-63-11515-81)

The following technical activities have been initiated or completed: (1) development and fabrication of an interconnection mask for the production of the diffused transistor WX-4001; (2) preliminary comparative test for the evaluation of an aluminum wire as a replacement of the conventional gold wire; (3) preliminary evaluation of the double-coating and exposure technique; preliminary evaluation of the new photoresist material.
Author

N64-13246 Picatinny Arsenal, Dover, N.J.
A PARTIALLY COOLED THRUST CHAMBER FOR VARIABLE THRUST OPERATION
W. F. Lehman and I. J. Glick Sep. 1963 25 p refs
(PA-TR-3119; AD-423031)

A composite thrust chamber, featuring refractory materials supplemented by low-flow water coolant, was designed, fabricated, and tested as a component in LRPL's liquid propellant variable thrust powerplant. This design consisted of an electroformed coolant passage bonded to a "KT" silicon carbide nozzle and Crystolon "R" chamber liner, and a spun tungsten radiation cooled expansion cone. The chamber satisfactorily withstood three complete thrust cycles (2000-200-lb nominal) over a total firing duration of 2 minutes. The chamber pressure deviated approximately 6 percent at comparable levels, demonstrating the absence of significant dimensional changes of the throat-hence, reproducible performance. The spun tungsten expansion cone eroded away completely. No difficulty was encountered in maintaining coolant pressure and flow rate, thus indicating satisfactory fabrication and operation of the electroform coolant passage.
Author

N64-13249 McDonnell Aircraft Corp., St. Louis, Mo.
CHEMICAL MILLING OF NARROW CLOSE TOLERANCE SLOTS IN ALUMINUM AND STAINLESS STEEL [Final Report]
Robert F. Weeks et al 10 Dec. 1963 23 p
(Contract AF 33(657)-11215)
(A239; AD-425102)

Five types of maskants and three etchant solutions were evaluated for the purpose of producing precision slots in stainless steel and aluminum. The screen printing maskants tested were Nelco Silk Screen Stop-Off Lacquer R-5018 and Meaker Stop-Off Lacquer. The photosensitive maskants tested were Kodak Photo Resist, Kodak Metal Etch Resist, and Kodak Photo Lacquer. The 321 stainless-steel panels were milled with steel chem-mill etchants per PS 20022.2, and the 7178-T6 aluminum panels were milled with either HCl solution or an alkaline etchant solution per PS 20023. The hydrogen ion normality was kept within a specified normality range during the steel chem-milling. The cutting rate of the etchant solution varied depending on the hydrogen ion concentration, the spraying conditions, and the maskant configuration. The only suitable maskant tested on steel was Kodak Photo Resist over Kodak Metal Etch Resist. The Meaker and Nelco maskants were tested for chem-milling aluminum. Both maskants were suitable for milling the larger slot widths.
Author

N64-13251 McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF MIN-KLAD INTERLOCK FOR USE AS AN EXTERNAL BODY INSULATION [Final Report]
T. C. Grimm 10 Dec. 1963 20 p
(Contract AF 33(657)-11215)
(A260; AD-425069)

Six Min-klad Interlock panels, bonded to stainless steel plates, were subjected to a high temperature (up to 930° F) air stream at an impingement angle of 10° for 6 minutes each. Min-Klad was applied to the surface of an actual flight vehicle body section, and a Min-Klad panel was subjected to JP-4 fuel, hydraulic fluid, and tap water for 16 hours. The Min-Klad specimens subjected to the hot air stream at Mach numbers up to 0.98 incurred only slight charring and erosion of their surfaces. There were no apparent adverse effects on Min-Klad due to 16-hour exposure to the above liquids nor was the Min-Klad insulated body section susceptible to damage by storage and handling. The main difficulty in applying Min-Klad was due to the poor working characteristics of the bonding agent, Epoxylite 5403.
Author

N64-13265* Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena
A STANDARD CHASSIS FOR GROUND SUPPORT EQUIPMENT
George F. Baker 15 Sep. 1963 19 p
(NASA Contract NAS7-100)
(NASA CR-53015; JPL-TM-33-152) OTS: $1.60 ph, $0.80 mf

This memorandum describes the mechanical design of a versatile rack-mounted chassis on which numerous different types of both common and special-purpose components may be mounted. Photographs of the chassis and its associated parts are included, along with examples illustrating the adaptability of the concepts which have been developed. A standard, low-cost chassis has been fabricated as a result of this design effort which has proven the flexibility of the system, the feasibility of stocking standard parts, the acceptability of minimum documentation, and the ease with which documentation changes may be accomplished.
Author

N64-13311 Rock Island Arsenal, Ill.
BEHAVIOR OF ORGANIC STRESS PREVENTING AGENTS IN NICKEL PLATING SOLUTIONS
Stanley L. Eisler 14 Oct. 1963 18 p refs
(RIA-TR-63-3346; AD-424466) OTS: $0.75

Two organic stress relieving agents, naphthalene 1,3,6, trisulfonic acid and saccharin were tested at three concentrations each in a nickel sulfamate plating bath by using a radioactive tag to determine the amount of the agent deposited with the plate. Tests were conducted at temperatures of 90°, 110°, and 130° F and current densities of 20, 40, 60 and 80 amp/ft^2. The amount deposited varied directly with concentration and indirectly with current density. It was also found that there was a relationship between the amount of the additive deposited and the compressive stress results taken from the literature.
Author

N64-13395* New Hampshire Ball Bearings, Inc., Peterborough
LOW TEMPERATURE MINIATURE BEARING FRICTION STUDY Final Report
Nov. 1963 233 p
(NASA Contract NAS5-2833)
(NASA CR-55268) OTS: $15.50 ph, $7.19 mf

Test data on both running and starting torque levels for lubricated bearings at 21°, −29°, and −54° C are presented. Two distinct quantity levels of both a silicone and a MIL-L-6085A lubricant were used in testing a variety of miniature-size bearings at distinct loading levels up to two pounds, at five separate speeds from starting to 10,000 rpm. The loading was applied by two different means: (1) preloading, using bearings with appropriately sized raceway-face relationships; and (2) deadweight loading of a single bearing. The relationship between viscosity and torque is shown to be considerably different for the two types of oil tested. A discussion of possible reasons why the observed torque of duplex bearing pairs is usually more than the sum of the torque of the two bearings tested separately under equal conditions at room temperature is included. M.P.G.

N64-13405* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE LUBRICATION PROBLEMS AT JPL
R. P. Thompson 2 Sep. 1963 16 p
(NASA Contract NAS7-100)
(NASA CR-53034; JPL-TM-33-148) OTS: $1.60 ph, $0.80 mf

The general approach of the Jet Propulsion Laboratory to spacecraft lubrication problems is presented. Several specific applications on the *Ranger*, *Mariner*, and *Surveyor* programs are discussed. A prediction of future lubrication problems on projects such as *Voyager* is made. Author

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-12440 Joint Publications Research Service, Washington, D.C.
EFFECT OF ALLOYING ELEMENTS ON THE TENDENCY OF STAINLESS CHROMIUM-NICKEL STEELS TO PITTING CORROSION
N. D. Tomashov, G. P. Chernova, and O. N. Markova *In its* Selections from Corrosion of Metals and Alloys, A Collection of Articles 16 Dec. 1963 p 2–18 refs (See N64-12439 04-01) OTS: $0.75

An investigation was made of the influence of various alloying elements on the resistance of austentite-chromium-nickel steel to pitting corrosion, as well as a study of the site of the appearance of pitting as a function of the steel composition. Mo, Si, and V demonstrated the greatest influence on corrosion resistance—resistance to pitting corrosion was increased when the content of these elements in the steel was raised to 5%. It was also shown that pitting arises in steel, primarily, in the boundary portions of the grains. R.T.K.

N64-12441 Joint Publications Research Service, Washington, D.C.
SEMIAUTOMATIC UNIT FOR RECORDING THE DISTRIBUTION OF POTENTIALS AT THE SURFACE OF MICROCONSTITUENTS OF AN ALLOY
A. I. Golubev and P. V. Strekalov *In its* Selections from Corrosion of Metals and Alloys, A Collection of Articles 16 Dec. 1963 p 19–24 refs (See N64-12439 04-01) OTS: $0.75

A method is described for semiautomatic recording of the potential difference on the surface of the structural components of an alloy. The intermetallic compound $NiAl_3$ was found to play the role of a cathode in an alloy of aluminum with 8% Ni in a 0.1N NaOH solution. R.T.K.

N64-12446 Joint Publications Research Service, Washington, D.C.
PROPERTIES OF CAST TUNGSTEN
M. I. Gavrilyuk and Ye. N. German *In its* Studies in Casting, Production, and Refining of High-Temp. Alloys 18 Dec. 1963 p 2–5 refs (See N64-12445 04-01) OTS: $1.00

Studies of some high-temperature properties of cast tungsten produced by arc melting in a vacuum furnace are reported. The short-term strength of tungsten in the deformed and recrystallized states, as a function of temperature, was determined, and the tabulated results show that the strength of the deformed metal varies little up to temperatures around 1200° C, drops very sharply at about 1500° C, and then decreases more smoothly with further increase in temperature. In contrast, the strength of annealed tungsten decreases continuously with increased temperature. In the low temperature region around 1000° C, the strength of deformed tungsten is about 60 kg/mm^2, whereas the strength of annealed tungsten is only 25 kg/mm^2; this difference decreases gradually up to about 2000° C where the strength becomes practically independent of the state. The long-term strength of the deformed metal was determined from the voltage producing tungsten breakdown; the plotted results show that the strength at 1500° C gradually decreases with time. The modulus of elasticity of tungsten was found to vary little up to temperatures of 1600° to 1700° C; at 1700° C it is equal to the modulus of elasticity of molybdenum at room temperature. M.P.G.

N64-12448 Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE PROPERTIES OF RHENIUM AND ALLOYS OF RHENIUM WITH TUNGSTEN AND MOLYBDENUM
Ye. M. Savitskiy, M. A. Tylkina, L. L. Zhdanova, L. A. Zubkova, V. N. Starkov et al *In its* Studies in Casting, Production, and Refining of High-Temp. Alloys 18 Dec. 1963 p 10–22 refs (See N64-12445 04-01) OTS: $1.00

Procedures of melting and investigating the deformability of binary and ternary alloys of tungsten and molybdenum with rhenium, producing rods, wires, sheet, and foil from these alloys, and determining their physiochemical properties are reported. The alloying of tungsten and molybdenum with rhenium was found to lead to an increase in their plasticity, workability, weldability, and strength characteristics. The introduction of rhenium into tungsten and molybdenum was found to raise their recrystallization points by 400° to 500° C. The following recrystallization points were established: Re-50 w/o Mo, 1350° C; W-20 w/o Re, 1550° C; and W-30 w/o Re, 1550° C. The tensile strength, impact viscosity, maximum degree of deformation, and other mechanical properties of rhenium and its alloys were also determined. M.P.G.

N64-12602 General Dynamics/Ft. Worth, Tex.
PROCESSING – CONVENTIONAL CHROMIUM PLATE ON HIGH STRENGTH STEEL, PROTECTION BY SPECIAL CORROSION INHIBITOR FLUID, EVALUATION OF Final Report
E. W. Furns Wright-Patterson AFB, Ohio, AF Materials Lab., 4 Nov. 1963 10 p refs
(Contract AF 33(657)-11214)
(FTDM-2960; AD-423074)

A study is made of the protection, by special corrosion inhibitor fluids, of conventional chromium plate on high-strength steel. A satisfactory, improved corrosion-resistant treatment was found for conventional chromium electroplate of 0.0020-in. to 0.0025-in. thickness. It is FMS 0003 epoxy primer, applied as specified. J.R.C.

N64-12643 Picatinny Arsenal, Dover, N.J.
THE COMPATIBILITY OF ADVANCED PACKAGEABLE ROCKET PROPELLANTS WITH MATERIALS OF CONSTRUCTION Final Report
J. D. Clark, A. E. Boyce, and S. P. Mobley Oct. 1963 20 p refs
(PA-TR-3115; AD-424080)

Compatibility of materials with chlorine trifluoride and Hydrazoid P for extended periods of time showed that aluminum and titanium are recommended tank materials for Hydrazoid P using polyethylene and Teflon for O-ring materials. Chlorine trifluoride is compatible with both aluminum and stainless steel for tank materials, while Teflon is the only nonmetallic O-ring material recommended. Author

N64-12647 Aeroprojects Inc., West Chester, Pa.
DEVELOPMENT OF ULTRASONIC WELDING EQUIPMENT FOR REFRACTORY METALS Interim Technical Progress Report, Jul.-Sep. 1963
Nicholas Maropis Oct. 1963 25 p refs
(Contract AF 33(600)-43026)
(ASD-TR-7-888 (VI); AD-422469)

Design, development, and construction of a 25-kw spot-type welding machine have continued, with emphasis on refining the design of the tension-shell ceramic transducer and coupling systems, analysis of the adequacy of the hydraulic system, and assembly of components onto the welding machine structure. Modifications are being made in the ceramic transducer design to eliminate arcing and overheating at high power inputs and to permit operation at full design power. The power-force programing system has been found to operate satisfactorily, with low response time, and components are being mounted on the welder frame. Final review of the air-hydraulic force system indicates that it should provide adequate force range, response time, and safety of operation. Author

N64-12648 General Dynamics/Ft. Worth, Tex.
MATERIAL – BRAZED HONEYCOMB PANELS – STRUCTURAL REPAIR – EVALUATION OF –
R. L. Jones 4 Nov. 1963 35 p refs
(Contract AF 33(657)-11214)
(FGT-299; AD-423075)

The present method of repairing brazed stainless-steel sandwich panels on the B-58 involves the attachment of patches by TIG spot welding techniques. This investigation has shown that the addition of certain foil brazing alloys to the fusion spot-welded joint interface of 17-7PH stainless steel will improve both the static lap shear and flexure fatigue strength. Six brazing alloys were evaluated, but only two were found to be completely beneficial. Of these two alloys, 97Ag-3Li was the better, increasing the flexure fatigue strength by 114%, and the static shear strength by 11%. Three MD 1698 test panels which had 1" diameter simulated damage repairs were sonic fatigue tested. All the panels had 97Ag-3Li braze alloy added to the outer skin-patch interface. All patches passed the 3 hour test at a 160 db sound pressure level. Author

N64-12652 Frankford Arsenal, Philadelphia, Pa.
EFFECT OF TEMPERATURE ON DELAYED FRACTURE OF ALUMINUM ALLOY 2024 IN THE PRESENCE OF LIQUID ZINC AMALGAM
B. J. Rogus Sep. 1963 19 p refs
(FA-R-1695; AD-425084)

Delayed fracture studies were conducted on aluminum alloy 2024 over a temperature range of 35° to 190° F. The alloy was solution treated at 920° F for 1 hour, cold water quenched, and then artificially aged at 375° F for 4 hours. Specimens were heated to desired temperatures in a liquid test bath. The specimens were then stressed to selected levels and were wetted using a liquid 2% zinc amalgam. Times to failure at different temperature levels were then determined. Test results showed that there was no significant variation in delayed fracture behavior within the range of 35° to 190° F. This fact indicates that mechanisms basic to the delayed fracture process, for this alloy and heat treatment, are essentially independent of temperature within this temperature range. Changes in the appearance of fractured edges for wetted specimens tested at different temperatures, however, suggest that mode of crack propagation possibly is temperature related. Author

N64-12658 Crucible Steel Co. of America, Pittsburgh, Pa.
DEVELOPMENT OF HIGH-STRENGTH, ELEVATED-TEMPERATURE, CORROSION-RESISTANT STEEL [Final Report, 15 Jan. 1962-31 May 1963]
A. Kasak, V. K. Chandhok, J. H. Moll, and E. J. Dulis Wright-Patterson AFB, Ohio, AF Mater. Lab., Sep. 1963 127 p refs
(Contract AF 33(657)-8458)
(ASD-TDR-63-766; AD-425593)

Previous work on Cr-Mo-Co stainless steels resulted in the development of a new hardenable high-strength steel, AFC-77. AFC-77, which contains nominally 0.15C-14.5Cr-5Mo-0.4V-13Co, exhibits an excellent combination of properties from subzero to about 1200° F and thus extends significantly the service temperature range attainable with hardenable stainless steels. Under the present contract, the complex precipitation reactions that are responsible for the strength of the Cr-Co-Mo steels were studied in detail. Strengthening after tempering at temperatures up to about 900° F is related to the precipitation of carbides. Above 1000° F, the Fe_2Mo Laves phase and the chi phase have been identified as the primary strengthening agents. Additional mechanical and physical property determinations were made on the Cr-Mo-Co steels. AFC-77 exhibits high net fracture strengths after tempering in the 600° to 800° F temperature range. Stress corrosion tests in salt environment indicated that the susceptibility of AFC-77 to stress corrosion cracking depends considerably on heat treatment. Author

N64-12663 Naval Radiological Defense Lab., San Francisco, Calif.
TOTAL HEMISPHERICAL EMITTANCE AND NORMAL SPECTRAL EMITTANCE (λ = 0.65μ) OF OXIDATION PROTECTIVE COATINGS Report, 27 Feb.-19 Dec. 1962
N. J. Alvares Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1963 36 p refs
(Contract AF 33-657-2-RD-155)
(ASD-TDR-63-269; AD-423179)

Measurements of the variation of total hemispherical emittance and normal spectral emittance ($\lambda = 0.65\mu$) with increasing temperatures have been made on some pack-cementation disilicide-type oxidation-resistant coatings for the refractory metals, molybdenum, tungsten, niobium, and tantalum. The normal spectral emittance($\lambda = 0.65\mu$) of the coatings on disc samples was determined with a micro-optical pyrometer, which was sighted into a blackbody hole, drilled in the sample, and then onto the adjacent area. The total hemispherical emittance of the coatings on ribbon specimens was found by use of a calibrated total radiation pyrometer, which sampled the energy radiated from a uniform temperature region established about the center portion of the electrically heated ribbon specimen. The diffuseness of the surface of the various coatings was found by taking angular distributions of the radiation emitted from the center portion of the sample ribbons at various temperatures with the total radiation pyrometer. The confidence limits placed on these data are ±15 percent. Author

N64-12664 General Dynamics/Ft. Worth, Tex.
SPACE RADIATOR RESEARCH – JOINING AND ENVIRONMENTAL TESTING OF MATERIALS
R. E. Johnson 15 Jan. 1962 44 p refs
(Contract AF 33(657)-11214)
(ERR-FW-115; AD-423177)

Successful radiator tube-fin samples were made of stainless steel tubes with stainless steel fins, columbium tubes with columbium fins, columbium tubes with copper fins, and stainless steel tubes with copper fins. Of questionable success, a combination of steel tubes and beryllium fins was achieved. Attempts to fabricate a beryllium tube–beryllium fin combination were unsuccessful, although a brazed beryllium tube assembly was successfully made. Environmental tests at temperatures up to 1600° F at vacuum of 10^{-7} mm Hg were performed on several coating systems. Data obtained led to a calculated emissivity reading, at typical operating temperatures and pressures of space radiators, of the coating system. Weight loss versus time was noted for most coatings investigated. Author

N64-12665 General Dynamics/Ft. Worth, Tex.
STRESS CORROSION CRACKING IN HIGH STRENGTH FERROUS ALLOYS
J. F. Hildebrand, E. W. Turns, and F. C. Nordquist Wright-Patterson, AFB, Ohio, AF Materials Lab., 4 Nov. 1963 46 p refs
(Contract AF 33(657)-11214)
(FZM-2690; AD-423387)

This paper describes tests performed to investigate the stress corrosion cracking of AISI Type 4340 steel in the 260,000 to 292,000 psi strength range. The results indicated that a shot-peened surface had more resistance to cracking than a machined surface. Electrodeposited silver and copper increased the susceptibility as did electroless nickel, vapor-deposited aluminum, and dry film lubricant. A patented electrolized plate, a silicone paint, and a flame-sprayed aluminum coating provided good corrosion protection for the machined surface. Nickel–cadmium diffusion coating provided satisfactory protection at a lower strength level. Bent beam specimen tests determined that contact with anodic metals increased slightly the resistance to stress corrosion cracking. Author

N64-12673 Lockheed Missiles and Space Co., Sunnyvale, Calif.
DIFFUSION BONDING: AN ANNOTATED BIBLIOGRAPHY
Scott J. Buginas, comp. Mar. 1963 33 p 89 refs
(Contract NOw-63-0050-C)
(LMSC-SB-63-44; AD-423723)

This bibliography contains 89 selected references on hot pressure welding and diffusion bonding from the years 1940 to 1962. Indexes are included. Author

N64-12697 Argonne National Lab., Ill.
SWELLING OF ALUMINUM-CLAD ALUMINUM-PLUTONIUM ALLOYS ON POSTIRRADIATION ANNEALING Final Report-Program 6.5.2
B. A. Loomis Nov. 1963 12 p refs
(Contract W-31-109-eng-38)
(ANL-6651)

The changes in density and hardness as a result of annealing at temperatures up to 600° C are reported for an aluminum-clad Al-5 w/o Pu and Al-10 w/o Pu alloy in which 89.3% and 75.6%, respectively, of the plutonium atoms were fissioned. The density of the irradiated specimens at room temperature decreased after pulse anneals of 15-min duration at temperatures above 525° C, whereas for lower annealing temperatures the density of the specimens increased. The hardness of the specimens at room temperature decreased substantially after annealing at temperatures between 275° C and 360° C. A specimen of 1100 aluminum which was heavily deformed by rolling was also annealed in a manner similar to the irradiated materials. The density of the aluminum at room temperature increased after pulse anneals at temperatures up to 600° C, and the hardness decreased after annealing at temperatures above 300° C. Author

N64-12721 Du Pont De Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
IRRADIATION OF TANDEM-EXTRUDED JOINTS BETWEEN ZIRCALOY AND STAINLESS STEEL
J. Walter Joseph, Jr. Oct. 1963 18 p refs
(Contract AF(07-2)-1)
(DP-859) OTS: $0.50

Tandem-extruded tubular joints between Zircaloy and stainless steel experienced no measurable loss of strength or serious bond deterioration during irradiation to neutron exposures greater than the exposures predicted for 20 years of service in a power reactor. As-extruded and cold-worked joints were subjected to axial tensile stresses during exposure to as many as 7.8×10^{20} fast neutrons per square centimeter at a temperature of about 50° C. Author

N64-12815 Aerojet-General Corp., Azusa, Calif.
INVESTIGATION OF STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS [Seventh Monthly Progress Report, 1 Apr.-30 Apr. 1963]
P. L. Jordan May 1963 25 p refs
(Contract DA-04-495-ORD-3069)
(L0414-01-23; AD-404215) OTS: $1.60

Results obtained to date indicate that the 6Al-4V titanium alloy is immune to stress-corrosion cracking in the annealed, quenched and aged, and as-welded conditions. The 20%-nickel maraging steel is found to be highly susceptible to stress–corrosion cracking in the annealed-and-aged condition. When the alloy is cold-worked 50% or 75% before aging, the resistance to stress–corrosion cracking is greatly increased. The 18%-nickel maraging steel was also found to be susceptible to stress–corrosion cracking. While the 18%-nickel grade was found to have a longer time-to-failure than the annealed-and-aged 20%-nickel steel in the distilled water, salt water, seacoast air, trichloroethylene, and 140° F water-saturated air environments, it showed some failures in tap water, chromate solution, and soluble oil solutions where the 20%-nickel grade

was not affected. As with the 20%-nickel steel it was found that prior cold-working decreased the stress–corrosion cracking susceptibility. Author

N64-12838 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMAL STABILITY OF HEAT-RESISTANT ALLOYS
N. M. Sklyarova, ed. 19 Sep. 1963 156 p refs A Collection of Articles transl. into ENGLISH of book "TERMOSTOYKOST' ZHAROPROCHNYKH SPLAVOV" Moscow, Oborongiz, 1962 p 3–169
(FTD-TT-63-147/1+2; AD-423594)

This collection of articles is a review of the methods for investigating the thermal stability of heat-resistant alloys. Special attention is devoted to procedures permitting not only a qualitative but also a quantitative evaluation of the thermal stability of materials subjected to heat treatment at high temperatures. The relation between thermal stability and the mechanical and physical properties of alloys is studied. Author

N64-12841 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF ULTRASOUND ON THE TENACITY AND PLASTICITY OF STATICALLY STRESSED BRASS
Ya. R. Kanavalau and V. I. Yafremau 10 Oct. 1963 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz.-Tekh. (Moscow), no. 1, 1961 p 114–119
(FTD-TT-63-898/1+2; AD-423597)

The effect of ultrasound on the tenacity and plasticity of statically stressed L-59 brass was investigated. The source of the ultrasound was a three-prong nickel "magnetostrictor" with an engine vibration frequency of 34 kc. A concentrator increases the vibration amplitude of the "magnetostrictor". Results indicate: (1) The effect of ultrasound on statically stressed brass causes a reduction in the properties of the metal. (2) The effect of ultrasound on brass, in the process of tensile testing, causes a simultaneous reduction in tenacity and plasticity. (3) Simultaneous reduction in tenacity and plasticity, under the effect of ultrasound, appears to be basically the result of the ultrasonic-vibration-effect and not the result of temperature rise. I.v.L.

N64-12851 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF ULTRASONIC OSCILLATIONS ON ENDURANCE AND PLASTICITY OF BRASS
Ya. R. Kanavalau and V. I. Yafremau 1 Oct. 1963 10 p refs Transl. into ENGLISH of an article from Vesti An SSSR, Ser. Fiz.-Tekh. Navuk, (Ukr.), no. 4, 1960 p 93–98
(FTD-TT-63-897/1+2; AD-424869)

Ultrasonic oscillations were found to cause simultaneous reduction in the tenacity and plasticity of hardened and fired brass. R.T.K.

N64-12867 Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
DEVELOPMENT OF ALUMINUM-BASE ALLOYS Second Annual Progress Report, Sep. 29, 1961–Sep. 30, 1963
A. P. Haarr 30 Oct. 1963 77 p refs
(Contract DA-36-034-ORD-3559RD)
(AD-423398; Rept. 7-63-AP59-S)

A tensile strength of 127,500 psi and a yield strength of 124,400 psi were obtained in an aluminum powder metallurgy alloy extrusion by combining precipitation hardening with dispersion hardening. High temperature solution heat treatment, high quenching rate, and long aging time were required to achieve these properties in an alloy containing 9.8 Zn, 4.0 Mg, 0.8 Cu, 1.1 Mn, 1.0 Fe, 1.3 Ni, 0.01 Cr, and 0.01 Ti. Five other alloys have achieved yield strengths of 120,000 psi or higher. The alloys all had low ductility, generally less than 1.0% for those having the higher tensile properties. Extruded sections have been hot forged with success. The forged billets have been fabricated into sheet by hot rolling only. Author

N64-12872 IIT Research Inst., Chicago, Ill.
FRACTURE OF METALS Interim Report, 22 Jun.–22 Sep. 1963
W. Rostoker 23 Sep. 1963 16 p refs
(Contract DA-11-ORD-022-3108)
(IITRI-B-183-14; AD-422090)

An attempt is in progress to understand the nature of delayed failure in structural materials wetted by low-melting liquid metals and under static loading conditions. It is shown that delayed failure occurs in age-hardened beryllium-copper wetted with mercury and in cold-worked 70/30 brass wetted with mercury, but not in annealed 70/30 brass or in beryllium-copper in the solution-treated and overaged state. Preexposure of age-hardened beryllium-copper to mercury at 50° and 100° C shows that, under certain conditions, the delayed failure under subsequent stress is accelerated in one case and rendered almost inoperative in another. Author

N64-12893 Joint Publications Research Service, Washington, D.C.
POSSIBILITIES AND PROBLEMS OF POWDER METALLURGY IN THE DEVELOPMENT OF NEW MATERIALS
I. M. Fedorchenko *In its* Develop. in USSR Powder Met. 22 Jul. 1963 p 1–14 refs (See N64-12892 04-01) OTS: $1.25

The role of powder metallurgy is discussed in terms of the development of new materials. Included were: the development of alloys hardened by dispersed inclusions of the solid phase; alloys based on the refractory compounds; antifriction materials; sealing materials; highly porous materials; friction materials; and materials produced by the rolling of the powders. C.L.W.

N64-12907 Mallinckrodt Chemical Works, Weldon Springs, Mo.
THE EQUILIBRIUM PHASES IN THE URANIUM-ALUMINUM-IRON ALLOYS IN THE PARTIAL DOMAIN URANIUM-UAl_2-UFe_2
30 Dec. 1963 18 p
(Contract W-14-108-eng-8)
(MCW-TR-1)

The ternary system uranium-aluminum-iron was investigated. The phase relations were determined in the uranium-rich portion up to the quasi-binary section UFe_2-UAl_2. The results obtained were based on investigations by thermoanalysis, chemical and X-ray methods, and microscopy. The extended three-phase equilibria is typical for the system in the solid state. Uranium solutions showed a limited ternary solubility, but not the intermetallic compounds UAl_2, $U(Fe,Al)_2$, UFe_2, U_6Fe. Tables are presented on the distribution of the liquid surfaces in the system U-UAL_2-UFe_2, and the extent of the four-phase liquid equilibria in the system U-UAl_2-UFe_2. Phase diagrams surrounding the ternary system U-UAl_2-UFe_2 are also included. R.T.K.

N64-12929 Solar, San Diego, Calif.
EVALUATION OF RMSP TUNGSTEN SHEET Quarterly Progress Report 1, 1 Jul.–30 Sep. 1963
F. St. Germain and M. R. Licciardello 29 Oct. 1963 113 p refs
(Contract NOw-63-0786-d)
(ER 1399-1; AD-423940)

Forty-eight tungsten sheets in 0.010-, 0.020-, 0.060-, and 0.100-inch thicknesses were received. Dimensional, visual, and dye penetrant inspections of the as-received sheet were performed, and the results were recorded for the serialized material. Several as-received sheets were found to have been damaged in transit and these are described. Two 0.060-inch and one 0.020-inch sheets were found to be of questionable quality. The remainder of sheets shipped were considered to be of acceptable quality for conducting the acceptance tests and formability studies to determine material uniformity. Author

N64-12934 Excelco Developments, Inc., Silver Creek, N.Y.
INVESTIGATION AND EVALUATION OF HIGH STRENGTH STEELS IN HEAVY GAUGES FOR LARGE DIAMETER SOLID PROPELLANT ROCKET ENGINE CASES [Technical Documentary Report, 30 Jul. 1962-31 Jan. 1963]
W. Abbott and D. Newell Edwards AFB, Calif., Rocket Res. Labs., [1963] 120 p refs
(Contract AF 04(611)-8517)
(AD-424490)

The research program on large alloy high-strength steels for large solid-propellant rocket engine cases is discussed. Physical and mechanical properties of AMS 6434, D6AC, and maraging 18% nickel steels are examined. Also examined are the following fabrication processes: welding, machining, forming, and heat treating. Author

N64-12935 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS
Willard H. Sutton Watertown, Mass., Army Mater. Res. Agency, Mar. 1963 31 p refs
(Contract DA-36-034-ORD-3768RD)
(AMRA-CR-63-01/3; AD-409518)

Sessile drop experiments were conducted in order to investigate the wetting (contact angle, θ) between pure nickel and single crystal α-Al_2O_3. Of the various factors affecting the contact angle, the impurities in the nickel were found to have the most pronounced effect. A contact angle of 123.5° was recorded for ultrapure Ni at 1500° C. Shear tests were conducted on the solidified Ni drops in order to assess the relative bond strengths, which were found to vary between 510 psi and 9,250 psi. The fracture modes and the chemical etching of the α-Al_2O_3 surfaces by molten nickel are discussed.
Author

N64-12986 Pennsylvania U., Philadelphia
NUCLEAR MAGNETIC RESONANCE IN TRANSITION METAL-ALUMINUM INTERMETALLIC COMPOUNDS Technical Report No. 6
Kenneth R. Atkins, Jerold Alan Seitchik, and Roger H. Walmsley [1962] 158 p refs
(Contract Nonr 551(28))
(AD-423292)

The Knight shifts of nonmagnetic atoms alloyed with elements of the first transition series were investigated to gain a further understanding of the mechanics of ferromagnetism in metals. The nuclear magnetic resonance in NiAl, FeAl, CoAl, and Ni_3Al was measured by inducing transitions between the Zeeman levels of a nuclear magnet in a uniform magnetic field. These transitions were then detected, and the measurement of the parameters associated with the resonance was made. A discussion of results and conclusions is included. J.E.T.

N64-13012* Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF THE WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS Quarterly Report No. 1, 21 Jun.-21 Sep. 1963
G. G. Lessmann and D. R. Stoner [1963] 70 p refs
(NASA Contract NAS3-2540)
(NASA CR-52347; WANL-PR-(P)-001) OTS: $6.60 ph, $2.30 mf

The purpose of the program is to evaluate and categorize refractory metal alloys in order to determine those most suitable for use in advanced alkali-metal space-electric-power systems. The following topics are included: alloy procurement and evaluation, welding studies, weld atmosphere control, annealing and aging, equipment, and bend ductility data sheets.
R.T.K.

N64-13019 Joint Publications Research Service, Washington, D.C.
TITANIUM ALLOY SHEET STAMPING
Yu. P. Davydov and G. V. Pokrovskiy 15 Jan. 1964 90 p refs Transl. into ENGLISH of the booklet "Tekhnologiya listovoy shtampovki titanovykh splavov", Moscow, Mashgiz, 1963 p 1-71
(JPRS-22746; OTS-64-21299) OTS: $2.25

This report review the following: (1) the basic properties of titanium and titanium alloys; (2) the influence of alloying on the stampability of titanium alloys; (3) the technological peculiarities of sheet stamping; and (4) safety techniques for work with titanium alloys. I.v.L.

N64-13023 Israel Program for Scientific Translations, Ltd., Jerusalem
NICKEL AND ITS ALLOYS, VOLUME I [NIKEL' I EGO SPLAVY]
I. I. Kornilov 1963 353 p refs Transl. into ENGLISH of a monograph, Moscow, Izd. Akad. Nauk SSSR, 1958
(Published for NSF and Interior Dept.)
(IPST Cat. no. 969; OTS-63-11098) OTS: $3.50

A textbook concerning nickel and its alloys is presented. Major subject areas include the history of the production and uses of nickel; nickel, its properties and compounds; the distribution of nickel in nature; nickel deposits; and the metallurgy of nickel. J.E.T.

N64-13025 Argonne National Lab., Ill.
IRRADIATION AND POSTIRRADIATION ANNEALING OF SOME ALUMINUM-BASE FUELS Final Report
C. F. Reinke Sep. 1963 41 p refs
(Contract W-31-109-eng-38)
(ANL-6665)

Irradiated specimens of 39 w/o U_3O_8 dispersed in aluminum and of aluminum-17.3 w/o uranium alloy were annealed. Each specimen was partially clad with aluminum. Gross swelling was not observed for the aluminum-39 w/o U_3O_8 dispersion specimens for burnup and annealing temperature levels ranging up to 1.0×10^{20} fissions per cc and 550° C, respectively. Small volume increases were found, however, and these were attributed to the aluminum reduction of U_3O_8, which is accompanied by measurable volume increases. The dispersion specimens and, in particular, the U_3O_8 particles sintered during irradiation at temperatures from 55° to 90° C in an effective thermal-neutron flux of between 1 and 3×10^{13} nv. Annealing at 550° C produced severe localized blistering on specimens of aluminum-17.3 w/o uranium alloy having burnups of 5.9×10^{20} fissions per cc. Similar conditions produced only a small uniform volume increase when the burnup was 1.4×10^{20} fissions per cc. Author

N64-13029 Emmanuel Coll., Boston, Mass. Research Language Center
GOLD IN SEA WATER [DAS GOLD IM MEERWASSER]
Fritz Haber Bedford, Mass., AFCRL Aug. 1963 44 p refs Transl. into ENGLISH from Z. Angew. Chem. [v] 40, 1927 p 303–314
(Contract AF 19(604)-8505)
(AD-424516)

A lecture is presented concerning the many methods used to extract gold from sea water. It is concluded that the gold content of sea water is low and varies widely with location. J.E.T.

N64-13036 Harvard U., Cambridge, Mass. Gordon McKay Lab.
ESR AND OPTICAL EXPERIMENTS ON DEEP-LYING IMPURITIES IN GERMANIUM AND SILICON
Lawrence C. Kravitz 14 Jun. 1963 158 p refs
(Contract Nonr-1866(10); Nonr-1866(16))
(HP-9; AD-423329)

This report describes combined infrared absorption and electron spin resonance experiments on deep-lying impurities in silicon and germanium. By monitoring the electron spin resonance signal of an impurity while simultaneously illuminating the sample with monochromatic infrared radiation, ionization and trapping processes which change the impurity population are detected. The results of this measurement are then compared with photoconductive response and Hall effect data on the same crystal. Experimental results on iron, chromium, and sulfur impurities in silicon and nickel in germanium are presented and discussed in terms of the ionization energies of the impurities and the processes. Author

N64-13037 Lexington Labs., Inc., Cambridge, Mass.
FEASIBILITY OF FORMING REFRACTORY FIBERS BY A CONTINUOUS PROCESS First Quarterly Progress Report, 25 Feb.–25 May 1963
William B. Campbell [1963] 28 p refs
(Contract DA-19-020-AMC-0068)
(AMRA CR-63-03/1; AD-417436)

Methods for continuous formation of refractory fibers, or whiskers, by vapor phase growth are under investigation. The vapor phase processes are: aluminum halide oxidation, and aluminum oxide reduction and recrystallization. Preliminary experimentation with the halide system at temperatures around 1200° C indicates that in order to obtain continuous fibers production, it is essential to control the supersaturation, control the temperature, and probably provide suitable nuclei for crystal growth. Author

N64-13067* Alcoa Research Labs., Aluminum Co. of America, New Kensington, Pa.
WELDABLE HIGH STRENGTH ALUMINUM ALLOYS Literature Survey
W. G. Fricke, Jr., E. G. Haney, W.A. Anderson, and H. Y. Hunsicker 20 Aug. 1963 90 p refs
(NASA Contract NAS8-5452)
(NASA CR-52372) OTS: $8.10 ph, $2.90 mf

Published information on the properties and characteristics of high-strength aluminum alloys was reviewed, with particular emphasis on their qualifications for use in welded cryogenic structures. The available information concerning effects of composition, fabricating, and heat treatment factors on the properties of the different types of alloys was examined to ascertain the most promising avenues for further development. The Al-Zn-Mg type alloys currently under development combine good weldability with fairly high strength and cryogenic temperature notch toughness. The Al-Cu type alloys are also considered to offer possibilities of improvement toward the program objectives. Author

N64-13080 Frankford Arsenal, Philadelphia, Pa.
EUDIOMETRIC DETERMINATION OF ACTIVE ALUMINUM IN ALUMINUM POWDER
George Norwitz and Herman Gordon Oct. 1963 21 p refs
(FA-TR-T64-1; AD-424455)

An investigation was made of the following factors that influence the eudiometric determination of active aluminum in aluminum powder: temperature control of eudiometer, need for a closed system, calibration of gas buret, use of Ascarite, adjustment of levels in initial measurement, means of dropping in sample, saturation of solutions with hydrogen, weighing sample, concentration of sodium hydroxide solution, temperature during dissolution, stirring, barometric corrections, effect of stearic acid and tallow, and effect of metallic and nonmetallic impurities. An improved eudiometer was developed. Author

N64-13095 Manlabs, Inc., Cambridge, Mass. Materials Research and Develop.
THERMOMECHANICAL TREATMENTS APPLIED TO ULTRA-HIGH-STRENGTH BAINITES Fourth Progress Report, 15 Aug.–15 Oct. 1963
S. A. Kulin [1963] 68 p refs
(Contract N600(19)-59811)
(AD-424403)

Fifty-percent austenite deformation in H11 results in considerable strengthening of the subsequently formed bainite. H11 in the bainitic condition (formed from either deformed or undeformed austenite) is strongly affected by refrigeration in liquid nitrogen (due to conversion of retained austenite) when tempering temperatures below 1000° F are employed. In both cases, a large secondary strengthening is observed on tempering between 1000° and 1100° F. This results in higher strengths and equivalent ductilities as compared to the correspondingly treated martensites. Austenite deformation in 4350 has little effect on the strength of the subsequently formed bainite, although such deformation does enhance the strength of martensite. H11 and 4350 bainites and martensites exhibit a large response to strain-tempering treatments. For both steels, small deformations (up to 3%) produce large strengthening effects. Yield strengths close to 400,000 psi have been obtained by the application of strain-tempering treatments (50% deformation) to both H11 martensite and bainite. Increasing the carbon content in 43XX steels enhances the strengthening response to strain-tempering. Author

N64-13101* McDonnell Aircraft Corp., St. Louis, Mo.
METALLURGICAL AND MECHANICAL PROPERTIES EVALUATION OF A HEAT TREATED 7Al-4Mo TITANIUM ALLOY FORGING Final Report
John Huelner 10 Dec. 1963 27 p
(NASA Contract NAS9-170; Contract AF 33(657)-11215)
(A247; AD-425056)

The room temperature long transverse and short transverse tensile properties were evaluated in addition to the longitudinal tensile properties. The Rockwell C hardness across longitudinal and transverse cross sections of the forging was determined. The grain flow, microstructure, and chemical composition were determined. The chemical composition and longitudinal tensile

properties, except for reduction in area, conformed to specifications. The short transverse and long transverse tensile properties, except for reduction in area, exceeded the required longitudinal properties. Author

N64-13102 McDonnell Aircraft Corp., St. Louis, Mo.
FABRICATION CHARACTERISTICS OF 8Al-1Mo-IV TITANIUM ALLOY Final Report
Gorman Morris 10 Dec. 1963 87 p refs
(Contract AF 33(657)-11215)
(A248; AD-425058)

Test were conducted to investigate the fabrication characteristics of 0.022-in.-thick and 0.063-in.-thick Ti-8Al-1Mo-IV alloy. The alloy was evaluated in the following test areas: (1) Room temperature mechanical properties for both gages of material conformed closely to data published by the vendor. (2) Uniform elongation values of 1% to 3% were obtained for 0.022-in. material at room temperature. A test temperature of 1400° F was required to increase the average uniform elongation values of specimens to 10%. (3) Minimum bend radius tests resulted in a bend factor of 4.3 for the 0.022-in. material, while a bend factor of 3 was established for the 0.063-in.-thick Ti-8Al-1Mo-IV. (4) Porosity was encountered in all fusion welds, which precludes any definite conclusions on the fusion welding characteristics of 0.063-in. thick Ti-8Al-1Mo-IV. (5) As-welded lap shear specimens of both gages of Ti-8Al-1Mo-IV acceptably met the failing load requirements of PS 22000. (6) Ti-8Al-1Mo-IV exhibited better rubber forming characteristics than did A-110At. (7) The 0.022-in.-thick Ti-8Al-1Mo-IV sheet was acceptably dimpled for 3/32-in. AD rivets, and the 0.035 in. sheet was dimpled for 5/32-in. Hi-Shear rivets. Author

N64-13103 McDonnell Aircraft Corp., St. Louis, Mo.
UNPUBLISHED MATERIALS— RESEARCH AND DEVELOPMENT PROGRAMS First Semi-annual Summary Report
10 Dec. 1963 111 p
(Contract AF 33(657)-11215)
(A328; AD-425075)

Abstracts of the following test programs are presented: (1) mechanical, physical, chemical, and miscellaneous properties of the light metals, low and ultra high-strength steels, austenitic stainless steels, nickel chromium steels, titanium alloys, nickel base alloys, and refractory metals; (2) mechanical, physical, and miscellaneous properties of plastic materials such as epoxys, phenolics, polyethylene, urethanes, and vinyls; (3) mechanical, physical, and miscellaneous properties of silicone rubber materials; (4) chemical and miscellaneous properties of organic finishes, inorganic finishes, surface conditioning treatments, and chemical finishes when exposed to a corrosive environment; (5) effects of inorganic finishes on the mechanical, physical, and chemical properties of refractory metals; (6) chemical and miscellaneous properties of lubricants; and (7) physical and chemical properties of heat-transfer fluids. I.v.L.

N64-13109 Fansteel Metallurgical Corp., North Chicago, Ill.
COLUMBIUM ALLOY SHEET ROLLING PROGRAM Interim Report No. 4, 7 Sep.-6 Nov. 1963
H. L. Kohn and R. M. Curcio 7 Nov. 1963 11 p
(Contract NOw-63-0231-c)
(AD-424593)

Conversion of FS-85 (Cb-27Ta-10W-1Zr) from sheet bar to finished 18-in. wide by 0.060-in. thick sheet has been completed. Data on this conversion are presented. Further processing of B-66 (Cb-5V-5Mo-1Zr) from the extruded sheet bar stage is described. Author

N64-13118 Universal-Cyclops Steel Corp., Bridgeville, Pa.
MOLYBDENUM SHEET ROLLING PROGRAM Interim Report, 26 Jul.-25 Oct. 1963
R. G. Mc Laughlin and W. J. Schoenfeld 18 Nov. 1963 56 p
(Contract NOas-59-6142-c)
(AD-423981; Rept. 22)

Release properties for Mo.5Ti and TZM alloy sheet are presented. Test results of 0.020-in. Mo. 5Ti sheet are included which show some scatter outside the limits of the release properties. Details of the melting and extrusion of additional TZM ingots are discussed. Author

N64-13119 General Dynamics/Fort Worth, Tex.
DEVELOPMENT OF CHEMICAL MILLED WAFFLE GRID BERYLLIUM STRUCTURAL PANEL
C. W. Rogers, A. C. Fehrle, and T. S. Love 4 Nov. 1963 35 p refs
(Contract AF 33(657)-11214)
(ERR-FW-135; AD-423388)

This report concerns the research and development of an aerospace structural panel made from QMV beryllium hot-rolled plate. Results of this program confirm the ability of today's technology to produce a satisfactory structural panel made from beryllium. The most critical problem encountered was the variation of apparent modulus of elasticity. Static strength was found to vary excessively with surface finish. Author

N64-13121 Aerojet-General Corp., Azusa, Calif. Structural Materials Div.
INVESTIGATION OF STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS [Monthly Progress Report, 1 May-31 May 1963]
R. L. Setterlund Jun. 1963 8 p
(Contract DA-04-495-ORD-3069)
(L0414-01-24; AD-406769)

Testing has been started on the final alloy of the program, a vacuum-cast 9%-nickel 4%-cobalt steel with approximately 0.30% carbon. This alloy has shown some failures in the 140° F water-saturated air environment. Author

N64-13123 General Dynamics/Convair, Fort Worth, Tex
PROCESS, REPAIR WELDING, HEAT TREATED STEEL MECHANICAL PROPERTIES, DETERMINATION OF
G. S. Vaarlela 4 Nov. 1963 21 p
(Contract AF 33(657)-11214)
(FTDM-3094; AD-423065)

The effect of the following variables on the mechanical properties of heat treated low alloy steel repair welded without subsequent reheat treatment was investigated: base metal composition and thickness; percent penetration of repair; repair welding filler composition; weld composition being repaired; and heat treat level of the base metal. With the use of a sufficiently strong repair weld filler, the failures occurred in the heat affected zone of the base metal. Variation of gage had a sizable effect. The 4340 steel with deep hardening characteristics showed higher "as repaired" properties than 4130 steel. All the chosen fillers air hardened more readily than the base metal. C.L.W.

N64-13124 Lewis, Co., Incorp., East Hartford, Conn.
PRODUCTION ENGINEERING MEASURE – CRYSTAL UNIT CR-(XM-46)/U Quarterly Report, No. 4, May 1963-Aug. 1963
Robert P. Mc Comb 1963 42 p refs
(Contract DA-36-039-SC-86737)
(AD-423885)

Quartz crystals utilizing AT-cut plates operating on the third overtone for filter application have been fabricated at 30, 45, and 60 Mc, respectively. The design of plates for 45 and 60 Mc is given. An evaluation of parameter measurements and unwanted modes distribution is presented. The electrode orientation is discussed as well as the electrode thickness versus unwanted mode distribution and level.

Author

N64-13125 United Aircraft Corp., East Hartford, Conn. Research Lab.

ANALYTICAL AND EXPERIMENTAL INVESTIGATIONS OF THE FRACTURE MECHANISMS OF CONTROLLED POLYPHASE ALLOYS Final Report, 29 Oct. 1962-29 Nov. 1963

J. A. Ford, R. W. Hertzberg, and F. D. Lemkey 29 Nov. 1963 92 p refs

(Contract N600(19)-59361)

(B-910068-4; AD-424208)

The technique of unidirectional solidification has been applied to the Cu-Cr, Al-Al_3Ni, and Al-$CuAl_2$ alloy systems, and controlled microstructures were produced which consist of either a parallel array of lamellae of whiskers of one phase aligned in a ductile matrix. Mechanical tests (tension and flexure) have shown that these controlled alloys exhibit reinforcing behavior. In addition, the effect of the reinforcing phase orientation on the strength of a composite was studied, using flexure tests on lamellar Al-$CuAl_2$ specimens. As expected, the strength of the composite decreased as the lamellae were rotated away from the position parallel to the flexural stress axis. Based on the mechanical test results, a new expression for the strength and modulus of a reinforced composite structure has been formulated which accounts for inequality of strain and inefficient load transfer brought about by premature fracture of the reinforcing phase.

Author

N64-13138 California Drop Forge Co., Los Angeles

FORGING 6AL 4V TITANIUM ALLOY Research And Development

William M. Croft, John F. Armitstead, Mark C. Jelmeland, and Stephen Elchyshyn 14 Jun. 1963 59 p refs

Forging parameters as they affect the microstructure of titanium alloy 6AL 4V were investigated. Twelve specimens were forged at various temperatures above and below the beta transus. Severity of deformation, considered to be a critical factor affecting the microstructure, is described in terms of the number of hammer blows required to reduce a given critical section of the forging. An analysis of the photomicrographs of each of the metallurgical specimens as relating to forging techniques is discussed. Results indicate that titanium alloys can be successfully forged if precautionary measures are taken to control temperatures, and severity and rate of deformation. Included in the discussion are the effects of alloying elements on the physical properties and microstructure of titanium alloys in general.

Author

N64-13247 McDonnell Aircraft Corp., St. Louis, Mo.

COMPRESSION TESTING OF X2020-T6 ALCLAD SHEET ELEMENTS [Final Report]

R. H. Brooks 10 Dec. 1963 16 p

(Contract AF 33(657)-11215)

(A237; AD-425103)

This test was conducted to determine the buckling and crippling characteristics of X2020-T6 Alclad aluminum sheet. Three built-up sheet metal specimens and twelve sheet metal elements of various configurations were tested in compression to determine the failing load and mode of failure. The build-up sheet metal specimens failed at a load of approximately 24,000 lb and failed in a relatively brittle manner with the specimens breaking into numerous small pieces. The sheet metal elements failed at loads varying from 1920 to 6080 lb depending on specimen configuration. All failures took place in typical crippling fashion.

Author

N64-13250 McDonnell Aircraft Corp., St. Louis, Mo.

EVALUATION OF GREAT LAKES STEEL CORPORATION STEEL ALLOY NAXTRA 100 [Final Report]

R. H. Brooks 10 Dec. 1963 11 p

(Contract AF 33(657)-11215)

(A240; AD-425100)

The testing consisted of determining the mechanical properties, welding and bending characteristics, and austenitic grain size. Although the first lot of material furnished exhibited low mechanical properties, the material submitted for retest met all the technical requirements.

Author

N64-13269* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

TENSILE PROPERTIES OF TUNGSTEN FROM 2500 TO 5400 F IN VACUUM

J. L. Taylor and Donald H. Boone Sep. 1963 14 p refs Repr. from Trans. Quart., v. 56, no. 3, Sep. 1963 p 643–655

(NASA Contract NAS7-100)

(NASA CR-53018; JPL-TR-32-359)

The effects of temperature and strain rate on the tensile properties of recrystallized powder metallurgy tungsten rod were studied. Tests were conducted on a standard specimen (length/diameter $\simeq$ 4) at strain rates of 0.02 and 2.0 per min. The strain-hardening exponent was determined to vary between 0.075 and 0.90, increasing with increasing strain rate and decreasing temperature. Intercrystalline-type fracture was observed at the lower strain rate at all temperatures studied. A ductility minimum occurs between 3000° and 4000° F (1650° and 2200° C). Ductile transgranular fracture, with reduction-in-area values between 90% and 100%, was found between 2500° and 5400° F (1370° and 2980° C) at 2.0 per min, an order of magnitude lower strain rate than previously reported by others. Above 3000° F (1650° C) at the 2.0 per min strain rate, stress-induced grain growth accompanied by a kind of work softening as shown by true stress–strain curves appears to account for the high ductility measured.

Author

N64-13300 Dow Chemical Co., Denver, Colo. Rocky Flats Div.

QUANTITATIVE METALLOGRAPHY OF PLUTONIUM USING POINT-COUNT TECHNIQUES

R. L. Greeson 2 Jan. 1964 16 p refs

(Contract AT(29-1)-1106)

(RFP-331) OTS: $0.50

Point-count analysis methods can be summarized as follows: (1) Point-count analysis methods on Pu_6Fe inclusions are reproducible. A statistical method of comparison has shown that the means of two or more populations, as determined by several operators, are not different assuming that they have unequal standard deviations. A comparison of point-count results to analytical results is very good. (2) Results of point-count analysis of PuC cermets appear to be in agreement with X-ray results. (3) Point-count analysis of varying amounts of alpha plutonium in delta plutonium is in agreement with X-ray analysis when the alpha fields are equiaxed. Alpha forms as stringers in chill-cast delta plutonium which has been rolled to more than 30% reduction. Hence different surfaces of the

same sample may show different amounts of alpha. In thin samples, such as these, edge views can be much more easily point-counted than analyzed by X-ray techniques. Author

N64-13301 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE ENGINEERING PROPERTIES OF COLUMBIUM AND COLUMBIUM ALLOYS
F. F. Schmidt and H. R. Ogden 6 Sep. 1963 250 p refs
(Contract AF 33(616)-7747)
(DMIC-188; AD-426255)

This report presents the results of a state-of-the-art survey covering columbium and 18 of its most promising alloys. All data are given in tabular and graphical form covering some of the more important physical, mechanical, and metallurgical properties for each material. References are given at the conclusion of each material section. Author

N64-13342 Department of Scientific and Industrial Research National Engineering Lab., East Kilbride (Gt. Brit.)
THE EFFECT OF SURFACE TREATMENT ON CORROSION- AND AIR-FATIGUE STRENGTH OF EN40c STEEL
A. C. Low Aug. 1963 39 p refs
(NEL-102)

Corrosion fatigue tests on En40c steel at a tensile strength of 125 to 130 tons/in^2 with nine different surface finishing treatments are reported. Aluminium spraying gave a fatigue-strength at an endurance of 100 million cycles much greater than that for any other treatment. Author

N64-13349 Joint Publications Research Service, Washington, D.C.
SOVIET RESEARCH ON HEAT RESISTANT STEELS AND ALLOYS
Fedor Fedorovich Khimushin 17 Jan. 1964 22 p Transl. into ENGLISH of Chapt. 1 and 2 from the book "Legirovaniye, termicheskaya obrabotka i svoystva zharoprochnykh staley i splavov", Moscow, Oborongiz, 1962 p 9–25
(JPRS-22781; OTS-64-21318) OTS: $0.75

Classification of heat resistant steels and alloys, the influence of alloying elements, and the mechanical properties are given for: (1) heat resistant steels with carbide and intermetallic strengthening; and (2) heat resistant nickel alloys with intermetallic strengthening. The demands placed on heat resistant steels and alloys for gas turbine installations are also discussed. R.T.K.

N64-13351* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
COBALT-BASE ALLOYS FOR SPACE-POWER SYSTEMS
John C. Freche, Richard L. Ashbrook, and Stanley J. Klima Rept. from J. Metals, Dec. 1963 p 1–7 refs
(NASA RP-116)

A series of cobalt-base alloys was developed which utilized only elements with extremely low evaporative-loss rates as alloying constituents in order to minimize possible structural deterioration by evaporation of volatile constituents in space applications. This alloy series compares favorably in high-temperature strength in both the as-cast and wrought condition with the strongest current cobalt-base alloys. Average rupture lives of 94 and 205 hr were obtained in the cast condition at 15,000 psi and 1800° F in air with two of the strongest high-temperature alloys, Co-25W-1Ti-0.4C and Co-25W-1Ti-1Zr-0.4C, respectively. These alloys were readily formed into sheet by hot rolling. Maximum elongations of 25% and 23%, respectively, were obtained in room-temperature tensile tests with sheet specimens of these alloys. Author

N64-13382 Joint Publications Research Service, Washington, D.C.
ALLOYS OF PLUTONIUM
S. T. Konobeyevskiy and V. I. Kutaytsev 3 Jan. 1964 13 p refs Transl. into ENGLISH from Issled. Splavov Tsvetnykh Metal., Akad. Nauk SSSR, Inst. Met. (Moscow), no. 4, 1963 P 17–24
(JPRS-22599; OTS-64-21207) OTS: $0.50

A micromethod for physiochemical investigation of plutonium and its alloys has been developed. Work with small samples using a microprocedure has caused no deterioration in the quality of the investigations, and has made it possible to obtain accurate data on equilibrium in the systems of alloys. A thermogram and magnetic susceptibility-temperature curves are given for a 48-gram sample of plutonium. In the investigation of the alloys, a microstructural method, thermal analysis, dilatometric analysis, X-ray diffraction study, measurement of microhardness, electric resistance, magnetic susceptibility, and other methods were used. Phase diagrams of alloys of plutonium with lithium, beryllium, molybdenum, and zirconium are given, and crystallographic principles characteristic of plutonium and its alloys are derived. E. W.

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-12583 Aerospace Corp., El Segundo, Calif.
COMPLEX TRANSITION METAL HYDRIDES
S. G. Gibbins 12 Nov. 1963 48 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-283; TDR-269(4210-10)-1; AD-425588)

A review of the properties of complex transition metal hydrides and a discussion of the probable mechanism requisite for stability are given. The absence of stoichiometric binary transition metal hydrides coupled with features common to the complex ones indicates that the primary stabilization mechanism of the transition metal–hydrogen bond is one involving multiple bonding between the metal and the stabilizing ligand. The multiple bond comprises of a σ bond, the electron pair being provided by the ligand, and a π bond, the electron pair being provided by the metal. Thus, negative charge that would have accumulated on the metal, if only a σ bond existed, is diminished. From a molecular orbital point of view, the π bond permits formerly nonbonding metal d orbitals to become bonding. Thus, the total energy of the system is reduced, and the stability is increased. Author

N64-12601 Cornell U., Ithaca, N.Y.
THE K-PHOTOIONIZATION CROSS SECTION OF HELIUM FROM 100A TO 250A Technical Report No. 3
J. F. Lowry Sep. 1963 99 p refs
(Contract DA-31-124-ARO(D)43)
(AROD-2810-13; AD-423658)

The K-photoionization cross section of gaseous helium has been measured in the range 100 A to 250 A by confining

the gas to a small cell. The results agree rather well with at least one of the theoretical calculations of the cross section that have been performed. The present measurements have been combined with data obtained previously to evaluate four of the five sum rules satisfied by the oscillator strengths. The values obtained for three of the sum rules agree closely with measurements of the quantities involved obtained independently, while the high value obtained for the ground-state binding energy of the helium atom is explainable on the basis of a poor extrapolation below 100 A, and the existence of only one experimental determination of the cross section below 100 A. Author

N64-12661 Harry Diamond Labs., Washington, D.C.
HYDROGEN SOURCES FOR FUEL CELLS
David Singman and A. F. Forziati 1 Nov. 1963 23 p refs
(TR-1168; AD-424580)

Commercially available gas, liquid, and chemical sources of hydrogen for use with fuel-cell batteries are compared. Cryogenic storage is shown to be the most efficient on both weight and volume bases. Chemical generators are suitable for applications requiring moderate quantities of hydrogen gas at infrequent periods. Compressed-gas cylinders are convenient when small quantities of bydrogen are desired. A bibliography of selected publications of the past five years is included.
Author

N64-12662 Aerospace Corp., El Segundo, Calif. Materials Science Lab.
SOLVENT EFFECTS ON THE ELECTRONIC SPECTRUM OF 4-METHYL-4-METHOXY-2-PENTANONE
D. J. Coyle, J. J. Mc Gee, and K. B. Eisenthal 22 Oct. 1963 10 p refs
(Contract AF 04(695)-269)
(TDR-269(4240-30)-2; SSD-TDR-63-269; AD-423151)

The ultraviolet absorption spectrum of 4-methyl-4-methoxy-2-pentanone was studied in the 1850 A to 3500 A region. In the pure state, a weak band was observed at 2870 A and a strong doublet at 1903 A and 1944 A. The long wavelength band was characterized as the $n \rightarrow \pi^*$ transition by a blue shift of the λ_{max} in going from nonpolar to polar solvents. The doublet was similarly identified as the $n \rightarrow \sigma^*$ transition. The shift of the $n \rightarrow \pi^*$ band was compared to that of acetone for the same nonpolar, polar, or hydroxylic solvent.
Author

N64-12672 Bendix Corp., Eatontown, N.J. Red Bank Div.
CERAMIC TO METAL SEALS FOR HIGH-TEMPERATURE THERMIONIC CONVERTERS Technical Report [1 Oct. 1962-30 Sep. 1963]
M. L. Dring Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Oct 1963 87 p refs
(Contract AF 33(657)-10038)
(RTD-TDR-63-4109; AD-425443)

A metallizing process has been developed by which a strongly adherent sintered tungsten film can be applied to commercially-available high-purity silica-free alumina. No fluxing materials or active metals which are susceptible to attack by cesium are used in this process. Bonding of alumina to molybdenum has been successful by several methods developed from the diffusion seal study. Some of these have been tested at 1500° C successfully, i.e., with neither structural failure nor loss of hermeticity resulting from the test. Methods of fabricating graded-composition, tungsten-alumina emitter and envelope structures have been developed. Techniques for making brazed joints between refractory metals and high-purity alumina metallized with tungsten, using high-temperature brazing alloys, are considered to be well enough developed for use of these structures near 1500° C. Tungsten, rhenium, hafnia, thoria, and yttria have been identified as the most promising materials for 2000° C service.
Author

N64-12812 Aeronutronic, Newport Beach, Calif.
CHEMICAL CORROSION OF ROCKET LINER MATERIALS AND PROPELLANT PERFORMANCE STUDIES, VOLUME ONE OF TWO Final Technical Report
D. L. Peters 15 Dec. 1963 79 p refs
(Contract NOw-61-0905-c; ARPA Order 22-62)
(U-2384; AD-425888)

The theoretical equilibria resulting from corrosion of refractory nozzle materials by hot combustion gases have been determined for a number of systems of interest. The refractories considered have included graphite (C), tungsten (W), TaC, HfN, TiC, ZrC, ZrB_2 MgO, and HfO_2. The bulk of the corrosion studies have been performed for "pure" species of arbitrary composition, including AlF_3, BF_2, BF_3, BOF, HBO_2, BeF_2, CO, CO_2, HCl, HF, H_2, H_2O, LiF, N_2, and condensed Al_2O_3 and BeO. In general, corrosion effects have been determined for temperatures in the range 1500° to 5000° K, and for a nominal total pressure (usually 1000 psia). Tungsten (W) and graphite (C) generally rank the most resistant of those materials considered. Tungsten has an advantage over graphite for combustion systems containing oxygen or hydrogen, whereas the reverse is true for systems based upon fluorine. Tantalum carbide (TaC) also is reasonably resistant to attack by many systems. No material considered, however, was capable of withstanding high-temperature attack by severely oxidizing atmospheres, such as CO_2 and H_2O.
Author

N64-12813 United Research Services, Burlingame, Calif.
EXPERIMENTAL STUDY OF THE EFFECT OF MATERIAL PROPERTIES ON COUPLING OF EXPLOSION ENERGY
Kenneth Kaplan Kirtland AFB, N. Mex., Research Directorate, May 1963 81 p refs
(Contract AF 29(601)-5360)
(AFSWC-TDR-63-47; AD-423739)

Small spherical high-explosive charges were used to load a series of cylindrical blocks of fine aggregate concrete, either at the surface of a block, within a block, or at the contact surface of two blocks. Measurements were made of the variations in concrete properties, of the total impulse delivered to the block supports, of the permanent deformations and craters, and of the air-blast pressures. It was found that material properties have a major effect on the total impulse transmitted to the material, little effect on the air-blast waves, and a very large influence on the sizes and shapes of the craters produced. Although crater dimensions appeared to vary approximately as the cube root of charge weight, both the crater volume and the total impulse varied by at least a factor of two, and scaled crater depth appeared to be approximately independent of burst geometry. The compressibility, as measured by Young's modulus, appeared to have greatest effect on the impulse, while the internal shear strength and other properties reflecting the internal structure of the material had greatest effect on crater dimensions.
Author

N64-12863 McDonnell Aircraft Corp., St. Louis, Mo.
SECOND REVISION OF MCDONNELL MATERIAL AND PROPERTY INDEX CODE
10 Dec. 1963 19 p
(Contract AF 33(657)-11215)
(A267; AD-425074)

The McDonnell content index code submitted herein contains a current listing of codings which have been assigned to

materials tested and types of property data obtained. Examples of this indexing system are also presented. This code was developed to expedite screening of test reports for specific materials and properties data. Author

N64-12902 Joint Publications Research Service, Washington, D.C.
CARBIDE HARD ALLOYS – THE MOST IMPORTANT PRODUCT OF POWDER METALLURGY
G. A. Meyerson 3 Jan. 1964 21 p refs Transl. into ENGLISH from Issled. Splavov Tsvetn. Metal., Akad. Nauk SSSR, Inst. Met. (Moscow), no. 4, 1963 p 266–278
(JPRS-22600; OTS-64-21208) OTS: $0.50

A general analysis is made of the relationship of the properties of carbide hard alloys (WC-Co, WC-TiC-Co, WC-TiC-TaC-Co, etc.) to their composition, structure, and technological methods of production. P.V.E.

N64-12905 Royal Aircraft Establishment, Farnborough, (Gt. Brit.)
THE INFLUENCE OF END GROUPS ON THE GLASS TEMPERATURE AND FLOW TEMPERATURE OF MACROMOLECULAR GLASSES [DER EINFLUSS DER ENDGRUPPEN AUF DIE GLASTEMPERATUR UND FLIESSTEMPERATUR VON MAKROMOLEKULAREN GLASERN]
K. Ueberreiter and U. Rohde-Liebenau London, Min. of Aviation, Sep. 1963 20 p refs Transl. into ENGLISH from Makromol. Chem. (Heidelberg), v. 49–50 (1961) p 164–181
(R.A.E.-Trans.-1045)

A homologous polymeric system of macromolecules is regarded as a binary system of end groups and middle groups. The glass temperatures of such systems are known to follow the glass temperature formula:

$$1/T_G = x_E\, 1/T_G^E + x_M\, 1/T_G^M$$

where T_G = glass temperature, x = mole fraction. It is proved that the glass temperature formula is also applicable to bridged end groups. The glass temperature formula was also found applicable to a homologous polymeric system with trichlorotriphenylmethyl end groups. Short chains with 2 TPM end groups have a higher glass temperature than higher molecular weight polymers of the same binary system. The glass temperatures of polystyrenes with 1–2 TPM end groups is between those with 2 TPM or 2 homogeneous end groups. The specific volumes of the binary systems of macromolecules follow the relation:

$$v = x_E v_E + x_M v_M.$$

Author

N64-12920 Army Missile Command, Huntsville, Ala.
BONDING OF FOAM PLASTICS BY MEANS OF HIGH-FREQUENCY HEATING
L. M. Koval'chuk 25 Oct. 1963 13 p refs Transl. into ENGLISH from Plasticheskiye Massy, no. 7, 1962, p 32–35
(RSIC-85; AD-423958)

The possibility of bonding foam plastics by means of internal heating in a high-frequency field that speeds up the process and gives a firm connection was investigated. It was established that some foam plastics could be bonded by carbamide adhesives in a short period of 5 to 7 seconds with little deformation. Resulting strength of bonding is comparable to the longer duration cold-bonding methods. J.E.T.

N64-12931 Brown U., Providence, R.I.
THE VISCOSITY OF NEON-HELIUM AND NEON-ARGON MIXTURES AT 20° C AND 30° C
J. Kestin and A. Nagashima Charlottesville, Va. U., School of Eng. and Appl. Sci., Oct. 1963 36 p refs Submitted for Publication
(Contract Nonr 3623(00); Proj. Squid)
(BRN-8-P; AD-423899)

The paper gives the results of the absolute determination of the viscosity of two binary mixtures: neon–helium and neon–argon, together with those of the viscosity of the three pure components. The measurements were performed with the aid of a high-precision oscillating-disk viscometer at 20° C and 30° C, and covered a range of pressures up to 35 atm (densities from 0 to 0.09 g/cm^3). The density effect can be expressed, essentially in the form of a temperature-independent linear correction in the case of the Ne–He mixtures, and in the form of a quadratic correction in the case of Ne–A mixtures, both applied to the excess viscosity $\Delta\mu = \mu - \mu_0$ in which μ_0 is a function of temperature only. Author

N64-12941* Hughes Aircraft Co., Culver City, Calif. Aerospace Engineering Div.
DEVELOPMENT OF ORGANIC SEALANTS FOR APPLICATIONS AT VERY LOW TEMPERATURES
I. M. Zelman, R. I. Akawie, and H. Harvey 30 Jun. 1963 95 p ref
(NASA Contract NAS8-2428)
(NASA CR-52256; P-63-57) OTS: $8.60 ph, $3.05 mf

The most promising candidate lox-safe sealant was found to be Kel-F 800 resin reinforced with glass fabric and using a Kel-F 800 based hot melt primer. It has enough flexibility at 76° K to pass the bend test, and its peel strength at 76° K is felt to be adequate. It failed to pass the contractor's impact test, however, and does not qualify as being lox-safe. Adiprene L-100 cured with castor oil and RTV-X511 silicone remain as the best cryogenic sealants, when reinforced with glass fabric, for use in a non-lox environment. Work on silicone polymers was continued. These were prepared by equilibration of tetravinyltetramethylcyclotetrasiloxane, tetrabutyltetramethylcyclotetrasiloxane, and octamethylcyclotetrasiloxane, using tetrabutylphosphonium hydroxide as catalyst. They were cured with dicumyl peroxide, but did not pass the low-temperature flexibility test even when reinforced with glass cloth. A foamed sealant, based on the Adiprene system, was developed for sealing the weld line crevice of the dome lox tanks. Author

N64-12951* Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
INVESTIGATION OF STRUCTURAL PROPERTIES OF FIBER GLASS FILAMENT-WOUND PRESSURE VESSELS AT CRYOGENIC TEMPERATURES Monthly Progress Report No. 5, 1–31 Nov. 1963
J. M. Toth, Jr. 9 Dec. 1963 33 p refs
(NASA Contract NAS3-2562)
(NASA CR-51419) OTS: $3.60 ph, $1.19 mf

Main effort has been in the liquid hydrogen testing area. The cryogenic pump pressurization system has become operative and functions satisfactorily. Excess leakage in a nickel-lined specimen prevented use of the pump system; subsequent use of helium pressurization permitted bursting the specimen at 1647 psi. This corresponds to hoop glass stresses of 617,000 psi. Additional effort has been expended on securing permeability data, but no results have been obtained to date. Author

N64-12952* Aeronutronic, Newport Beach, Calif. Research Lab.
STRUCTURAL BEHAVIOR OF COMPOSITE MATERIALS First Quarterly Technical Report, 14 Feb.–14 May 1963

S. W. Tsai 24 May 1963 55 p refs
(NASA Contract NAS7-215)
(NASA CR-52410; U-2122) OTS: $5.60 ph, $1.85 mf

Work was concentrated on (1) theoretical prediction of the composite moduli of unidirectional fiber-reinforced media, and (2) experimental verification of the results. Important aspects are described in this report. Author

N64-13041 Illinois U., Urbana
MECHANICAL CHARACTERISTICS OF POLYCRYSTALLINE NiO Final Report
R. J. Herbst and A. L. Friedberg Sep. 1963 97 p refs
(Contract DA-11-022-ORD-3467)
(AROD-2892:2; AD-423663)

Observations made on the elastic behavior of polycrystalline nickel oxide are presented. Some of the observations made are as follows: (1) The electrical conductivity of polycrystalline nickel oxide is a function of the 1/6 power of the oxygen pressure at temperatures in excess of 700° C. (2) The X-ray unit cell parameter of nonstoichiometric nickel oxide compositions is related to the oxygen pressure maintained during heat treatment. (3) The modulus of elasticity of nickel oxide is significantly reduced by heat treatment in oxygen. (4) The modulus of elasticity on nickel oxide increases anomalously with temperature at temperatures below its Neel temperature (250° C). P.V.E.

N64-13042 Wisconsin U., Madison
DYNAMIC MECHANICAL PROPERTIES OF POLYMERS AND THEIR SOLUTIONS AND GELS Final Report
John D. Ferry 12 Nov. 1963 5 p refs
(Contract DA-11-022-ORD-3336; Grant DA-ARO(D)-31-124-G110)
(AROD-25898; AD-425156)

The viscoelastic properties, in small deformations, of various polymer systems were studied over wide ranges of temperature, time, and frequency. The mechanical behavior was related to chemical structure and molecular motions, focusing attention on certain parameters including free volume, the monomeric friction coefficient, and the spacing between entanglement coupling loci. The following were studied: (1) relation of monomeric friction coefficient and entanglement spacing to molecular structure; (2) dependence of monomeric friction coefficient and entanglement spacing, viscosity; and terminal relaxation time on composition in very concentrated polymer solutions; and (3) mechanical properties in the glass transition temperature. R.T.K.

N64-13051 European Atomic Energy Community, Brussels (Belgium)
STRUCTURAL INVESTIGATION OF SAP-ISML USING ELECTRON MICROSCOPY AND X-RAY DIFFRACTION [STUDIO DELLE PARTICOLARITA STRUTTURALI DEL SAP-ISML MEDIANTE LA MICROSCOPIA ELETTRONICA E LA DIFFRAZIONE DEI RAGGI X]
G. Bonissoni and M. Paganelli (ISML) Oct. 1963 47 p refs
In FRENCH; ENGLISH summary Presented at the Journees Met. d' Automnne, Paris, 15–19 Oct. 1962
(Contract EURATOM 003.605 ORGI; Contract EURATOM 026.61.7 ORGI)
(EUR 403.i) Available from Belgian American Bank and Trust Co., N.Y., account no. 121.86: 70 Belg. Fr.

Changes in the structure of aluminum oxide produced during sintering process under vacuum (at 600° C) were investigated by X-ray diffraction. It has been observed that amorphous aluminum-oxide crystallized in "Al_2O_3-η" and "Al_2O_3-X" structures. An investigation of oxide particle distribution was made by electron microscope on SAP-ISML extruded bars at 4%, 7%, 10%, and 14% Al_2O_3. In lower oxide percentage samples, Al_2O_3 particles are uniformly distributed and consist of platelets with linear dimensions between 0.02μ and 0.1μ, the mean distance among them being about 0.1μ to 02μ. In higher oxide percentage samples, many Al_2O_3 particles gather, forming aggregates which adhere to the replica. To investigate the effect of high-temperature annealing on SAP-ISML structure, 4% AL_2O_3 sheets annealed 24 hours at 500° C have been examined by transmission electron microscopy. No start of recrystallization has been observed in these conditions; nevertheless, subgrain linear dimensions increase a few tenths of a micron. Author

N64-13062* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPATIBILITY OF MATERIALS WITH LIQUID OXYGEN
C. F. Key and W. A. Riehl 23 Oct. 1963 95 p refs
(NASA TM X-51346; MTP-P&VE-M-63-14) OTS: $8.60 ph, $3.05 mf

The test instrument and procedure developed by Lucas and Riehl were used to determine the compatibility of a wide variety of materials with liquid oxygen (lox). This method is based upon the tendency of materials to react with lox on impact and is commonly known as the "ABMA Tester." Pertinent data from tests have been compiled, and the findings are presented in this report. Materials are discussed according to the following classifications: (1) lubricants, (2) sealants and threading compounds, (3) thermal and electrical insulation, (4) elastomers, plastics and adhesives, (5) gaskets and packing, (6) metals, alloys, and solders, (7) dye penetrants, and (8) solvents, cleaning solutions, and miscellaneous. Author

N64-13132 Emanuel Coll., Boston, Mass. Research Language Center
TEMPERATURE RELATION OF THE MAGNETOSTRICTION OF SATURATION OF IRON SILICIDE MONOCRYSTALS [TEMPERATURNAIA ZAVISIMOST' MAGNITOSTRIKTSII KREMNISTOGO ZHELEZA]
A. Ia. Vlasov and I. L. Gus'kova Bedford, Mass., AF Cambridge Research Labs. Mar. 1963 11 p refs Transl. into ENGLISH of an article from Izv. Vyss. Uchebn. Zavedenii, Fiz. (Tomsk), no. 5, 1962 p 156–160
(Contract AF 19(604)-8505)
(E-T-R-63-4; AD-414740)

The magnetostriction constants of iron silicide monocrystals (3.5% Si) for the axes [100] [110] and [111] in plane (110) and their change in the temperature interval from −196° to 800° C are determined. The domain structure of the investigated samples is also examined. Author

N64-13212 California U., Berkeley. Lawrence Radiation Lab.
SOME PROPERTIES OF SOLID HYDROGEN AT SMALL MOLAR VOLUMES
Guenter Ahlers (Ph. D. Thesis) 24 Sep. 1963 140 p refs
(Contract W-7405-eng-48)
(UCRL-10757) OTS: $2.50

Apparatus and experimental procedures are described for the measurements of properties of solid hydrogen over the volume range from 15 cc/M to 23 cc/M and the temperature range from 1.3° K to 20° K. The lattice heat capacity of hydrogen was measured at constant pressure, and at 22.56, 19.83, and 18.73 cc/M. The results are compared with simple theories, and with the lattice properties of other solids. Some thermodynamic properties of solid hydrogen are deduced from the heat-capacity measurements. Author

N64-13213 California U., Berkeley. Lawrence Radiation Lab.
THE VAPOR PRESSURE OF INDIUM SULFIDES AS FUNCTIONS OF COMPOSITON AND TEMPERATURE
Alan R. Miller (Ph. D. Thesis) 21 Oct. 1963 45 p refs
(Contract W-7405-eng-48)
(UCRL-10857) OTS: $1.00

A dynamic method for obtaining pressure-vs-composition data in two-component systems is demonstrated for part of the indium-sulfur system. The composition range of the phase designated as indium sesquisulfide was investigated by means of X-ray diffraction and mass spectrometry in the temperature interval 600° to 900° C. The results show that the phase has a significantly wide solubility range and that the reported In_3S_4 phase does not exist. The major vapor species above indium sesquisulfide in this temperature interval are In_2S and S_2.
Author

N64-13253 McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF DRY FILM LUBRICANTS ON ALUMINUM AND MAGNESIUM [Final Report]
M. S. Tucker 10 Dec. 1963 44 p
(Contract AF 33(657)-11215)
(A262; AD-425071)

Vendors' literature has recommended the application of dry film lubricants to various aluminum and magnesium alloys. In order to evaluate these recommendations, combinations of several dry film lubricants applied to representative aluminum and magnesium alloys with various surface preparation procedures were tested. Of the combinations tested, the optimum combination of surface pretreatment and dry film lubricant in the case of 7075-T6 aluminum alloy was found to be Electrofilm 5396 lubricant applied to a hard coated surface. When testing HK31A magnesium alloy, the optimum combination was that of Electrofilm 5396 applied to a surface pretreated with a Dow 17 Type I coating, followed by Everlube 620 lubricant applied to the same pretreated surface. Author

N64-13267* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
STRUCTURAL AND HIGH-TEMPERATURE TENSILE PROPERTIES OF BORON PYROLYTIC GRAPHITE
W. V. Kotlensky and H. E. Martens 16 Dec. 1963 15 p refs
(NASA Contract NAS7-100)
(NASA CR-53013; JPL-TR-32-299) OTS: $1.60 ph, $0.80 mf

Several producers of boron pyrolytic graphite have reported it to have improved mechanical properties over pyrolytic graphite. The tensile properties in the basal plane direction and the structural changes accompanying heating and straining over the range room temperature to 2200° C were found to be similar to pyrolytic graphite. At 2480° and 2760° C pyrolytic graphite with approximately 1% boron exhibits greater ductility than pyrolytic graphite. In comparing the structural transformation of these two materials, the presence of boron appears to enhance the strain induced transformation at 2480° and 2760° C and to inhibit the thermally induced transformation due to heating alone at all temperatures up to 3000° C. Author

N64-13315 Rock Island Arsenal, Ill.
PACKAGING IN TRANSPARENT BAGS
Linden H. Wagner 8 Aug. 1963 44 p refs
(RIA-TR-63-2583; AD-425370) OTS: $1.25

Bare steel panels, overwrapped in vinylidene chloride copolymer, panels coated with an emulsifiable rust preventive, and panels protected with VCI materials were sealed in plastic bags. These packs were then subjected to fresh water immersion, static and dynamic humidity, cyclic exposure and one year of indoor storage tests to determine the suitability of plastic bags for packaging applications. The control packs, after one year of indoor exposure at ambient temperature, provided adequate protection without the use of VCI materials. It was also determined that the packs were unable to provide adequate protection to the control panels when immersed in fresh water and exposed to high humidity conditions. Cyclic exposure revealed that the emulsifiable rust preventive coating was unable to withstand exposure at high temperature. Incompatibility between polystyrene and the vinylidene chloride copolymer overwrap was noted at high temperature. A yellowish coloration was also noted on several plastic bags containing VCI materials. Author

N64-13316 General Dynamics/Fort Worth, Tex.
EFFECTS OF RADIATION ON THREE SILICONE DIELECTRIC FLUIDS
B. E. Curtsinger 31 Jul. 1963 69 p refs
(Contract AF 33(657)-7201)
(NARF-63-71; FZK-9-188; AD-421030

Three silicone dielectric fluids were irradiated while their electrical properties were being measured. There were samples of each fluid at temperatures of 40° F, 200° F, and 400° F. A mixed neutron-gamma radiation field was provided by the ground test reactor. The samples were subjected to a maximum gamma dose of 2.5×10^{10} ergs/gm(C) and a maximum integrated neutron flux of 1.7×10^{15} n/cm^2 ($E > 2.9$ Mev.). Extensive preirradiation measurements were made of the dielectric constant, dissipation factor, resistivity, and dielectric strength of each fluid. These measurements were used as a standard to which the irradiation and the postirradiation measurements were compared. Author

N64-13318 General Electric Co., Cincinnati, Ohio
HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 30, Part A, 15 Sep.-15 Nov. 1963
30 Dec. 1963 35 p refs
(Contract AT(40-1)-2847)
(GEMP-30A) OTS: $0.75

Activities are reported in the following areas: (1) Radiation effects in BeO—volume expansion in BeO specimens irradiated at 600° C and 800° C to a dosage of about 10^{21} nvt (≥ 1 Mev) ranged up to approximately 3.6%. Measurements of the porosity and strength of specimens of 5-micron grain size irradiated at 100° C indicated that grain-boundary separation occurs at 2 to 2.5×10^{20} nvt(≥ 1 Mev). Helium retention measurements indicated that up to 40% of the helium formed escaped from specimens in irradiation up to about 10^{21} nvt (≥ 1 Mev). (2) Fission gas diffusion in unfueled ceramic materials—an ion source was fabricated, and magnetic-field strengths of the source were measured as a function of current flow. A vacuum system capable of 3×10^{-7} torr was assembled, and the optimum operating conditions for a thermistor manometer were determined in the pressure range from 5×10^{-4} to 9×10^{-3} torr. (3) Fission-product transport processes in refractory-metal fuel systems—a high temperature tungsten furnace was assembled and tested to a temperature of 2800° C. A glow discharge assembly was constructed and tested. (4) Internal conversion ceramic-fuel-element research—research was undertaken to establish the feasibility of thoria as an internal conversion fuel in BeO. R.T.K.

N64-13390 Mound Lab., Miamisburg, Ohio
PREPARATION AND PROPERTIES OF PLUTONIUM CARBIDE: A BIBLIOGRAPHY [1947-NOV. 1963]
C. P. Johnston, F. D. Lonadier, and J. A. Powers 27 Nov. 1963 11 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1169) OTS: $0.50

N64-13395 Stanford U., Calif.
PHASE RELATIONS AND ELECTRICAL AND THERMAL PROPERTIES IN THE SYSTEMS $SnTe$-Bi_2Te_3 AND $PbTe$-Sb_2Te_3
Richard A. Reynolds (M.S.Thesis) Mar. 1963 30 p refs
(DMS Master's 63-2)

The pseudobinary systems $PbTe$-Sb_2Te_3 and $SnTe$-Bi_2Te_3 have been investigated using differential thermal analysis, X-ray diffraction, and optical metallographic techniques. The system $PbTe$-Sb_2Te_3 contains a simple eutectic with negligible solid solubility of either component in the other. The system $SnTe$-Bi_2Te_3 forms a solid solution from 45% to 100% Bi_2Te_3, the phase forming by peritectic reaction at 45% Bi_2Te_3 and exhibiting a minimum in the liquidus at 85% Bi_2Te_3. The maximum solid solubility of Bi_2Te_3 in $SnTe$ is at least 5%. Alloys containing 52-1/2% to 85% Bi_2Te_3 are n-type; other compositions are p-type. Resistivity for all alloys increases nearly linearly with temperature from 85° K to 500° K; above 500° K resistivity decreases. Seebeck coefficients are considerably smaller at 85° K than at 300° K. Thermal conductivity is approximately independent of composition and temperature. Author

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-12419 European Organization for Nuclear Research, Geneva (Switzerland)
AUTOMATIC CALCULATION OF THE PI AND MU BEAMS FORTRAN PROGRAM (CERN 6008 B56/57). APPLICATION TO THE PROJECT OF PI-MU BEAMS OF THE PS [ACCELERATOR] [CALCUL AUTOMATIQUE DES FAISCEAUX DE PI ET DES FAISCEAUX DE MU PROGRAMME FORTRAN (CERN 6008 B56/57). APPLICATION AU PROJET DE FAISCEAU PI-MU DU PS]
A. Citron, J. Fronteau, and J. Hornsby 30 Aug. 1963 95 p ref In FRENCH
(CERN 63-30)

A program in FORTRAN is presented for use in the study of the entire π-beam sputtering from a target within a circular accelerator with alternating weak magnetic gradients, such as the PS accelerator, and for determining the μ-beam which is associated with secondary disintegration during flight. The π-beam is considered as the result of superimposed monokinetic elementary beams, and the calculation is based on the Michaelis plot. M.P.G.

N64-12452 Joint Publications Research Service, Washington, D.C.
HIGH EFFICIENCY COMPUTING SYSTEMS
E. Z. Yevreinov and Yu. G. Kosarev *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 1-35 refs (See N64-12451 04-01) OTS: $5.00

Means are investigated for the construction of computers the output of which is greater than billions of operations per second. It is proposed that a computing system be used which represents a group of similar computers tuned program-wise to solve problems. It is pointed out that the greatest difficulties lying in the way of creating such a computing system are connected with manufacturing technology. Therefore, it is proposed that the computing system be constructed on the basis of a computing medium which is an n- dimensional lattice at each node of which a universal element is located. This element may carry out logically a full set of functions, signal delay, and the function of union with the nearest neighboring elements. The element is also tuned to carry out any of the given functions. The basic problems are formulated which come up in working out the computing system, and means of solving these problems are indicated. Author

N64-12453 Joint Publications Research Service, Washington, D.C.
ELEMENTS IN THE SYNTHESIS OF CONTROL EQUIPMENT FOR DIGITAL COMPUTERS
N. G. Bruyevich *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 36-61 refs (See N64-12451 04-01) OTS: $5.00

A method of encoding statements which describe events that take place in a digital computer and which are important to its logic is suggested. Tables of the logical requirements for control equipment of the machine are presented. Criteria for minimizing the logic equations arise from the requirement of simplicity in the equipment. Author

N64-12454 Joint Publications Research Service, Washington, D.C.
CONCERNING THE TECHNICAL-ECONOMICAL APPROACH TO THE SELECTION OF BASIC PARAMETERS FOR NEW TECHNICAL MEANS OF AUTOMATIC CONTROL
V. I. Chernetskiy *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 62-78 refs (See N64-12451 04-01) OTS: $5.00

A method is proposed for the selection of basic parameters for new technical means of automatic control of complex automation systems. It is assumed that the question of expediency in the application of a control machine is decided in advance and that, on the basis of a preliminary analysis of existing technical automation means and existing control systems, an approximate choice of the basic parameters may be made which approximately satisfies the conditions of ensuring the imposed quality control and installation and operation conditions. The basic parameters selected in this way are referred to as the "old" system. They will actually be parameters of the "old" system in the case where modernization of existing control systems is considered and in the case where a new control system is developed on the basis of individual networks of several existing control systems. Finally, they will be technically realized parameters at the achieved level of production for the projected control systems, which satisfy approximately the conditions which ensure the required quality control and installation and operation condition. Thus, the selection of parameters is based on taking into account the technical-economical factors of the "old" system. I.v.L

N64-12455 Joint Publications Research Service, Washington, D.C.

MULTI-OPERATION SYSTEMS AND TERMINAL AUTOMATONS

L. I. Feygin *In its* News of the Acad. of Sci. USSR, Dept. of Tech Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 79–85 ref (See N64-12451 04-01) OTS: $5.00

Multioperation systems are investigated for which it is possible to construct a tentative diagram or work schedule. Elementary units are isolated which may be joined together to obtain multioperation systems of great complexity. A terminal automaton is synthesized which simulates the work of one of these units Author

N64-12460 Joint Publications Research Service, Washington, D.C.

CONTROL OF RANDOM WANDERING OF AN AUTOMATON WHEN INTERNAL NOISES ARE PRESENT

V. F. Krapivin *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 142–151 refs (See N64-12451 04-01) OTS:$5.00

External intentional effects of a finite [or terminal] automaton are investigated in the presence of noises when the control signals are used only with certain probabilities. The problem is reduced to controlled random wanderings. Results are presented for the simplest cases of one automaton chasing the other. Author

N64-12461 Joint Publications Research Service, Washington, D.C.

METHODS OF INVESTIGATING STATISTICAL RELAY EFFECT AUTOMATONS WHEN STOCHASTIC DISTURBANCES ARE PRESENT

L. L. Rotkop *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 152–161 refs (See N64-12451 04-01) OTS: $5.00

The design of a statistical relay effect automaton is developed for the case of variations in the quality indications in the form of random fixed correlated sequences. The Markov process is used in the design development. I.v.L.

N64-12464 Joint Publications Research Service, Washington, D.C.

MINIMUM QUADRATIC CRITERIA FOR CONTROL SYSTEM QUALITY

A. I. Lur'ye *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 196–204 refs (See N64-12451 04-01) OTS: $5.00

A control equation system is derived beginning with describing the action of a control system by a system of linear differential equation of the first order with constant coefficients in which the coordinates of the control units and metering device is the coordinate of the regulating device ("control"). I.v.L.

N64-12465 Joint Publications Research Service, Washington, D.C.

CONCERNING THE FASTEST DERIVATION OF AN IMAGE POINT BEYOND THE LIMITS OF A GIVEN PHASE PLANE REGION

A. B. Sabbin *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Cybernetics, no. 4, 1963 11 Dec. 1963 p 205–220 refs (See N64-12451 04-01) OTS: $5.00

Optimal systems have been studied with respect to rapid action, in which the goal of a transient process is some point of a phase plane. Recently, increasing attention has been attracted by the optimal problems concerning the arrival of the process at some subspace of the phase space rather than at a point. The problem is solved for the derivation of a system from this given (in a sense "dangerous") region of the phase plane in the least time. The geometric method reveals a number of properties of transient processes which are difficult to discover with analytical investigations of the problem. However, the final results may be formulated purely analytically. Author

N64-12466 Joint Publications Research Service, Washington, D.C.

CONCERNING THE RIGIDITY OF MOTION IN A SLIDING HYPERPLANE FOR SEVERAL AUTOMATIC CONTROL SYSTEMS WITH VARIABLE STRUCTURE

Ye. I. Gerashchenko *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 221–230 refs (See N64-12451 04-01) OTS: $5.00

Among the control systems which use nonlinear control laws, the simplest, from the point of view of technical realization, retaining high control quality are those systems with a nonlinear correction circuit of the "key" type. High control quality in these systems is ensured in particular by the existence of a sliding region. This work is actually a development of an idea expressed in a previous work in which the necessary and sufficient conditions for asymptotic rigidity (stability) of motion in a sliding hyperplane are given. Author

N64-12467 Joint Publications Research Service, Washington, D.C.

SUPPLEMENT TO THE ARTICLE BY E. I. GERASHCHENKO

S. V. Yemelyanov and V. A. Taran *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 231–232 (See N64-12451 04-01) OTS: $5.00

Beginning with Gerashchenko's theorem concerning the rigidity of motion in a hyperplane, a theorem for determining the rigidity of motion in a sliding hyperplane and a theorem for determining the highest possible degree of stability of motion in such a hyperplane are presented. These theorems are of importance in the construction of a highly automatic control system with variable structures. I.v.L.

N64-12469 Joint Publications Research Service, Washington, D.C.

ON A METHOD OF ANALYSIS OF OSCILLATION STABILITY FOR LINEAR SYSTEMS WITH VARIABLE PARAMETERS

F. A. Mikhaylov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 243–255 refs (See N64-12451 04-01) OTS: $5.00

The problems in analyzing oscillation stability for linear systems with variable parameters are investigated. A method is discussed for obtaining oscillation stability conditions based on some special forms of linear transformations of the initial system of differential equations. Author

N64-12470 Joint Publications Research Service, Washington, D.C.

ON SEVERAL PROBLEMS IN THE THEORY OF INVARIANCE IN MULTIVARIATE AUTOMATIC SYSTEMS

P. I. Chinayev *In its* News of the Acad. of Sci. USSR, Dept of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 256–261 refs (See N64-12451 04-01) OTS: $5.00

The application of equivalent initial conditions and the principle of invariance is investigated for the synthesis of multivariate automatic systems. A system of algebraic equations is presented for determination of the equivalent initial conditions for a multivariate system. The method is illustrated by an example of the synthesis of a bivariate automatic system. Author

N64-12473 Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF A RANDOM NUMBER GENERATOR
G. G. Vaynshteyn and V. B. Svechinskiy *In its* News of the Acad. of Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 288–297 refs (See N64-12451 04-01) OTS: $5.00

A system for obtaining random numbers is discussed which is based on filling a random interval of pulses of fixed frequency with subsequent enumeration. It is shown that for a given accumulator capacity it is possible to obtain a distribution of random numbers approaching uniformity by raising the filling frequency. Methods are given for evaluating nonuniformity in the distribution obtained. A scheme is presented for the generation of random numbers uniformly distributed within a controlled range. Author

N64-12483 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ITERATION METHODS IN SOLUTION OF A LINEAR BOUNDARY PROBLEM
V. Ye. Shamanskiy *In its* J. of Computer Math. and Mathematical Phys., Selected Articles 20 May 1963 p 1–17 refs (See N64-12482 04-01) OTS: $7.60

The problem of integrating a system of n linear differential equations

$$dx/dt = A(t)x \qquad (1)$$

with boundary conditions

$$Bx(0) + Cx(l) = d. \qquad (2)$$

is considered. R.T.K.

N64-12494 Joint Publications Research Service, Washington, D.C.
VARIATIONAL PROBLEMS CONCERNING OPTIMUM CONDITIONS OF CONTROL PROCESSES WITH FUNCTIONALS DEPENDING ON INTERMEDIATE COORDINATE VALUES
V. A. Troitskiy *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 1–7 refs (See N64-12493 04-01) OTS: $1.00

A study is made of variational problems concerning conditions of optimum control processes with functionals depending on intermediate coordinate values. I.v.L.

N64-12593 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
FUNCTIONAL DESCRIPTION OF AN ADVANCED AUTOMATIC ROCKET IMPACT PREDICTOR
Raymond Dise Oct. 1963 26 p
(ERDA-82; AD-423247)

Functions performed by an advanced model of a special-purpose computer and display system, Automatic Rocket Impact Predictor (ARIP), are described. Based on atmospheric data and rocket flight parameters, mathematical equations are solved on a high-speed computer and provide prefiring information for the prediction of impact points of the unguided stages of multistage rockets. Equations and circuit diagrams describing specific applications of various system components and techniques are given. Author

N64-12625 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROPERTIES OF RANDOM PULSE PROCESSES
Ya. I. Khurgin 8 Oct. 1963 10 p refs Transl. into ENGLISH from Tr. Vses. Soveshch. po Teorii Veroyatnosti i Mat. Statist. (Yerevan), 1960 p 72–78
(FTD-TT-62-1147/1+2+4; AD-423603)

Attention is given to the properties of random pulse processes which are encountered in many radio-engineering problems. Pulse self-oscillations were used as an example taking into account fluctuation processes in circuits and tubes, or the sequence of spikes above a certain defined level of random noise. In general, attention was directed toward a single class of such processes which is reasonably descriptive of many practical interesting cases. Consideration was given in greater detail to the simplest class of random pulse processes in which the sequence interval between the moments of pulse appearances is a sequence of positive, independent, identically distributed random variables having probability density. C.L.W.

N64-12686 Aerospace Corp., El Segundo, Calif.
OPTIMIZATION, A MOMENT PROBLEM, AND NONLINEAR PROGRAMMING
Lucien W. Neustadt 23 Jul. 1963 40 p refs
(Contract AF 04(695)-169)
(SSD-TDR-63-178; TDR-169(3540-10)TN-1; AD-423112)

This report deals with an optimization problem which is an abstraction and generalization of minimal-fuel guidance problems. The general problem is formulated as a moment problem. A theorem which asserts the existence of a solution to the moment problem is proved, and a characterization of the solution is also provided. As a result of this characterization, the solution to the problem can be obtained by solving a low-order convex problem in nonlinear programming, which is particularly suitable for solution on a digital computer. Finally, the general theory is applied to the problem of determining a minimum-fuel midcourse correction for a spaceflight. An additional result is that if the equations of motion of the space vehicle can be approximated by equations of a special form, and if $n(n \leq 6)$ components of the vehicle's position and velocity vectors must take on given values at a given terminal time, then a minimum-fuel maneuver for achieving these end values will consist of not more than n impulsive corrections. Author

N64-12688* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL PREDICTIONS OF NONLINEAR DIFFUSION WITH HOMOGENEOUS RECOMBINATION AND TIME-VARYING BOUNDARY CONDITIONS
Walter A. Reinhardt Washington, NASA, Jan. 1964 38 p refs
(NASA TN D-2126) OTS: $1.00

The periodic solution of a unidimensional time-varying diffusion equation with a nonlinear sink term and unsteady boundary conditions is obtained from the partial differential equation and boundary conditions approximated by a set of difference equations. An initial condition merely produces a transient that decays as the time variable increases in value. The remaining solution is periodic and independent of the initial condition. The periodic solution is characterized by a set of envelopes (within which the concentration varies), dependent on the frequency of the concentration variation and on the nonlinear sink term coefficient. Author

N64-12822 Emmanuel Coll., Boston, Mass. Research Language Center
THE CONDITIONALITY OF MATRICES [OB OBUSLOVLENNOSTI MATRITS]
D. K. Faddeev Bedford Mass., AFCRL, Apr. 1963 9 p refs Transl. into ENGLISH from Tr. Mat. Inst., Akad. Nauk SSSR no. 53, 1959 p 387–391
(Contract AF 19(604)-8505)
(E-T-R-63-8; AD-414738)

Some generalities of matrix conditionality are described, and the sense of the condition numbers N and H of a matrix A is examined in detail for a roughly approximate probability scheme. J.E.T.

N64-12836 Frankford Arsenal, Philadelphia, Pa.
DIGITAL COMPUTER SIMULATION OF THE PERFORMANCE OF SMALL SOLID PROPELLANT ROCKET MOTORS
James M. De Leo Sep. 1963 35 p refs
(FA-R-1694; AD-425164)

A mathematical model of small solid propellant rocket has been programed for use with a Univac Solid State 90 Digital Computer by means of FORTRAN I and FORTRAN II. In addition to calculating the pressure-time and thrust-time transients, the program computes time-averaged pressure, thrust coefficient, thrust, flow rate, and burning rate, as well as total impulse and specific impulse. The report includes the derivation of equations, the method of solution, the program in FORTRAN I and FORTRAN II, an example solution compared with experiment, and a recommended procedure for use of the computer program in the design and development of a small solid propellant rocket motor. Author

N64-12857 Rhode Island U., Kingston
THE QUADRATURE OF SOME EXPONENTIAL TRANSFORMS OF BESSEL FUNCTIONS [Scientific Report No. 4]
Julius Kane Bedford, Mass., AFCRL, Oct. 1963 8 p ref
(Contract AF 19(604)-7983)
(AFCRL-63-513; AD-425460)

Indefinite integrals involving products of exponential functions, cylindrical functions of integral order, and polynomials are explicitly evaluated. Author

N64-12923 Aberdeen Proving Ground, Md. Ballistic Research Labs.
ON THE RELATION OF PASCAL'S TRIANGLE TO CERTAIN FUNCTIONS
K. A. Pullen, Jr. Aug. 1963 47 p refs
(BRL-1214; AD-424611)

Pascal's Triangle is a tabulation of all integers in an arrangement which permits formation of coefficients of $(1 + x)^m$ by a process of summation. The present report shows that the numbers in the triangle are intimately associated with a wide variety of polynomials and functions. A tabulation of coefficients in terms of the numbers of the triangle is included. Author

N64-12940 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
HEAT 1 – A ONE DIMENSIONAL TIME DEPENDENT OR STEADY STATE HEAT CONDUCTION CODE FOR THE IBM-650
R. J. Wagner AEC Natl. Reactor Testing Station, 22 Apr. 1963 78 p
(Contract AT(10-1)-205)
(IDO-16867) OTS: $1.75

This program for the IBM-650 obtains a numerical solution to the one dimensional heat conduction equation in slab or cylindrical coordinates. The solution is obtained using a finite difference approximation to the partial differential equation derived by an integral method. The boundary conditions are of the form that a factor times the temperature plus a factor times the gradient equals a time dependent quantity. The thermal conductivities, heat capacities, and factors appearing in the boundary conditions can be a function of temperature. In this code, the temperature dependent quantities are described by a third order polynomial expression. A time dependent and point wise space dependent heat source is allowed. This program was coded primarily for the time dependent problem; however, when a steady-state solution is requested, changes are made in the time dependent equations to obtain the steady-state solution Author

N64-12942* Rensselaer Polytechnic Inst., Troy, N.Y.
NONLINEAR COMPENSATION OF A SECOND AND THIRD ORDER SYSTEM WITH DRY FRICTION
C. N. Shen and Hubert Wang (Gen. Dyn./Pomona) N. Y., Am. Inst. of Elec. Engr. [1962] 20 p refs Presented at the AIEE Summer Gen. Meeting, Denver, 17–22 Jun. 1962
(NASA Grant NsG-14-59)
(AIEE-CP-62-1061) AIEE: $0.50 members, $1.00 nonmembers

Systems having dry friction nonlinearity can be stabilized by introducing intentional nonlinear passive compensation. For small ramp inputs it is necessary to increase the damping by a derivative control which becomes saturated for high ramp rates. To decrease the steady-state error at high ramp rates and achieve stability, a dead-zone before the integrator is used. A scheme for an input adaptive system is presented. Author

N64-12984 Rohm and Haas Co., Huntsville, Ala.
ENGINEERING RESEARCH Quarterly Progress Report
John J. Brisbane and Donald A. Willoughby 1 Nov. 1963 63 p refs
Contract DA-01-021-ORD-11878)
(P-63-20; AD-423195)

The effective gage length for bonded-end tensile specimens having a circular cross section was developed as a function of Poisson's ratio and the length-to-diameter ratio. A new method for the analysis of transient-state heat conduction problems for a solid propellant grain having any general star-shaped internal perforation was developed. Explicit finite difference equations were employed which were written for a conformally mapped coordinate network which was compatible with the boundaries of the grain. A generalized IBM 7090 computer program written in FORTRAN II was developed to solve transient-state heat conduction problems in star-perforated solid propellant grains using this method for a variety of initial conditions, boundary conditions, and exothermic chemical reactions. Author

N64-12987 Columbia U., New York N.Y.
A MONOTONICITY PROPERTY OF THE POWER FUNCTIONS OF SOME TESTS OF THE EQUALITY OF TWO COVARIANCE MATRICES
T. W. Anderson and S. Das Gupta 25 Sep. 1963 13 p refs
(Contract Nonr-266(33))
(CU-68-63; AD-422211)

Invariant tests of the hypothesis $\Sigma_1 = \Sigma_2$ are based on the characteristic roots of $S_1 S_2^{-1}$ (i.e., $c_1 \geq c_2 \geq \ldots \geq c_p$), where Σ_1 and Σ_2 and S_1 and S_2 are the population and sample covariance matrices, respectively, of two multivariate normal populations; the power of such a test depends on the characteristic

roots of $\Sigma_1 \Sigma_2^{-1}$. It is shown that the power function is an increasing function of each ordered root of $\Sigma_1 \Sigma_2^{-1}$ if the acceptance region of the test has the property that if $(c_1, \ldots, c_p)$ is in the region, then any point with coordinates not greater than these, respectively, is also in the region. Examples of such acceptance regions are given. The hypothesis $\Sigma = I$ is also discussed. Author

N64-12992 Massachusetts U., Amherst Polymer Research Inst.
REVISED COMPUTER PROGRAM FOR X-RAY RADIAL SCAN DATA PROCESSING
C. R. Desper 24 Jul. 1963 6 p
(Contract Nonr 3357(01))
(ONR-TR-33a, Addendum to ONR-TR-33; AD-420278)

A computer program for X-ray radial-scan data processing was revised to permit storage of the background deck and thus to allow more efficient operation. In this program, the data for the entire scan are stored in memory; the background deck is read in; and a card at a time of the results is typed out. A set of operating notes for the new program is given along with a revision of the X-ray correction factor. C.L.W

N64-12995 Wisconsin U., Madison Mathematics Research Center
A LOCALIZATION PRINCIPLE FOR A CLASS OF ANALYTIC FUNCTIONS
D. A. Storvick Sep. 1963 3 p refs
(Contract DA-11-022-ORD-2059)
(MRC-427)

A localization principle is formulated for a class of analytic functions. J.R.C.

N64-12996 Wisconsin U., Madison Mathematics Research Center
ONE-PARAMETER EXPONENTIAL FAMILIES GENERATED BY TRANSFORMATION GROUPS
R. Borges and J. Pfanzagl Aug. 1963 25 p refs
(Contract DA-11-022-ORD-2059)
(MRC-409; AD-424684)

Consider a one-parameter exponential family generated by an arbitrary group of transformations of an abstract sample space. It is shown without topological assumptions about the group that such a family has either densities of the type of the normal distribution or of the type of the gamma distribution with respect to an invariant measure. Author

N64-13040 Princeton U., N.J.
Final Report, 1 Oct. 1962-30 Jun. 1963 [GENERALIZATIONS OF ARBITRARY ELLIPTIC SYSTEM OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS AND CAUCHY-RIEMANN EQUATIONS IN SEVERAL VARIABLES]
[1963] 3 p refs
(Contract DA-31-124 ARO(D)-41)
(AROD-244-61; AD-411919)

Results have been established concerning generalizations of the theorems of de Rham and Hodge, generalizations of the Neumann problem, and generalization of the results of a paper by D. C. Spencer concerning arbitrary elliptic pseudogroups. C.L.W.

N64-13082 Stanford U. Calif.
ON THE NAVIER-STOKES INITIAL VALUE PROBLEM, I
Hiroshi Fujita and Tosio Kato 11 Oct. 1963 108 p refs
(Contract Nonr-225(11))
(Tech. Rept. 121; AD-423241)

Using the theory of fractional powers of operators and the theory of semigroups of operators, existence theorems for 3-dimensional flows through a Hilbert space approach are developed. In this work the flow is considered in a bounded domain D in R^3 with boundary δD of class C^3, and the boundary condition imposed on the velocity at δD is homogeneous. Extension of the method to general cases, in particular, to the case of an unbounded domain, is explained. One of the main results of the development is the following theorem: Let u be a solution of the equation $[du/dt = -Au + Fu + Pf(t), t > 0]$ in an open interval I, where Pf is Hölder continuous as a H_σ -valued function and f = f(t,x) is Hölder continuous in I X D. Then u(t,x), $\Delta u(t,x)$, $\Delta\Delta u(t,x)$, and $\delta u(t,x)/\delta t$ are Hölder continuous in I X D. [H is the Hilbert space of real vector functions in $L_2(D)$ with the inner product (,) defined in the usual way. The set of real vector functions ϕ such that div $\phi = 0$ and $\phi \epsilon C_0^\infty(D)$ is denoted by $C_{0,\sigma}^\infty(D)$, and H_σ is the closure of $C_{0,\sigma}^\infty(D)$ in H.] P.V.E.

N64-13092 Stanford U., Calif.
ESTIMATING THE CURRENT MEAN OF A NORMAL DISTRIBUTION WHICH IS SUBJECTED TO CHANGES IN TIME
H. Chernoff and S. Zacks 31 Oct. 1963 44 p refs
(Contract Nonr-225(52))
(Tech. Rept. 91; AD-425901)

The application of Bayesian inference to a tracking problem, in which possible changes in direction are accounted for an observations taken before the latest change are discounted, is reviewed. The method of deriving a translation invariant Bayes estimator led to a fairly complicated expression. However, a considerable simplification was attained when it was assumed that, at the most, one change in the mean may occur. The results of the Monte Carlo experiments showed that the Bayes estimator derived under the assumption of "at most one change" (A.M.O.C.) was very efficient even if more than one change occurred, provided that the expected number of changes was not greater than one. However, the A.M.O.C. Bayes estimators were not efficient when there were two or more changes unless the last change was considerably larger than the previous ones. An ad-hoc estimation procedure was designed to use the relatively simple A.M.O.C. Bayes estimator in such a way as to avoid its shortcomings in the case of several changes. It consisted of "detecting" the last time point of change and applying the A.M.O.C. Bayes to the ensuing observations. It seemed rather efficient although it can be improved upon in situations where there is available considerable information on the nature of the time points of change. I.v.L.

N64-13093 RAND Corp., Santa Monica, Calif.
LINEAR PROGRAMMING AND EXTENSIONS
George B. Dantzig Aug. 1963 635 p refs
(Contract AF 49(638)-700)
(R-366-PR; AD-418366)

The theory and solution of linear inequality systems are discussed as follows: the linear programing concept; origins and influences; formulating a linear programing model; linear equation and inequality systems; the simplex method; proof of the simplex algorithm and the duality theorem; the geometry of linear programs; pivoting, vector spaces, matrices, and inverses; the simplex method using multipliers; finiteness of the simplex method under perturbation; variants of the simplex algorithm; the price concept in linear programing; games and linear programs; the classical transportation problem; optimal assignment and other distribution problems; the transshipment problem; networks and the transshipment problem; variables

with upper bounds; maximal flows in networks; the primal-dual method for transportation problems; the weighted distribution problem; programs with variable coefficients; a decomposition principle for linear programs; convex programing; uncertainty; discrete variable extremum problems; Stigler's nutrition model; and the allocation of aircraft to routes under uncertain demand. R.T.K.

N64-13096 Michigan U., Ann Arbor Inst. of Science and Tech.

EFFECTS OF PHASE ERRORS ON THE AMBIGUITY FUNCTION

W. M. Brown and C. J. Palermo Nov. 1963 17 p refs Presented at the 63rd Intern. Conv. of the Inst. of Elec. and Electron. Engr., New York, 25–28, Mar. 1963 Reported in IEEE Intern. Conv. Record, Pt. 4, 1963

(Contract DA-36-039-SC-78801)

(Rept. 2900-347-R)

The lack of perfect coherence (specifically, phase errors) in a radar or sonar system limits system accuracy and resolution. Two types of phase errors are considered here: (1) time phase errors which appear as a multiplicative factor exp $[j\alpha(t)]$ on the received pulse; local oscillator drift is a typical source of such a phase error; (2) frequency phase errors (or dispersion) which appear as a multiplicative factor exp $[j\beta(\omega)]$ on the Fourier transform of the received pulse; such phase errors appear if propagation "constants" or reflection characteristics change as a function of frequency over the bandwidth of the transmitted pulse. The system error is taken as the shift of the center of the ambiguity function. Resolution is defined as the radius of gyration of the ambiguity function. Author

N64-13098 General Electric Co., Philadelphia, Pa. Missile and Space Div.

A SUPERPOSITION PRINCIPLE FOR A SYSTEM OF ANALYTIC ORDINARY DIFFERENTIAL EQUATIONS

M. Wachman Oct. 1963 14 p

(Contract AF 04(694)-222)

(R63SD88; AD-424492)

Given a set of analytic differential equations $\eta(t) = \sum_{i=1}^{\lambda} g_i$ $(\eta(t)\ t)$ with $\eta(t_o) = \eta_o$; it is then shown that if the closed form solution $\xi_i\ (t)$ to the set of equations $\xi_i = g_i\ (\xi_i,\ t)$ for some of the i is known, it is possible to write a series expansion for $\eta(t)$ which is a better approximating series than the Taylor series of $\eta(t)$ about $t = t_o$. Author

N64-13100 Oslo U., Blindern (Norway) Inst. for Theoretical Physics

ALPHACODE FOR WEGEMATIC 1000 AND ALVAC 3-E

John Midtdal Uppsala, Almqvist and Wiksells, 1963 46 p refs (Supported by Aeronautical Research Lab., OAR)

(*Its* Rept. No. 15; AD-403047)

The Alphacode scheme described in this report is a compiling one. It has some resemblance to other known alphacodes, especially the Deuce Alphacode with which it has many common features. However, an attempt was made to make the system more flexible and comprehensive by incorporating both single and double length arithmetic, both fixed point and floating point representation. Each instruction contains, usually, only one data address which can be placed in the A column. In addition, a parameter may be used which itself, or the address of which, can be placed in the B column. In the PS column necessary information is added which is not naturally put into the A or B columns. Explanatory notes and remarks wanted on the coding sheet (and on tape) may be written as comments. All such comments are jumped over by the compiler and are not translated. Red type text written in this column, however, will occur in the translated program as text. The translated program produced by the compiler consists of one or more program channels. The compiler itself will always take care of every change to a new channel when necessary. I.v.L.

N64-13131 Mitre Corp., Bedford, Mass.

A COMPUTER PROGRAM FOR DETERMINING THE RADAR CO-ORDINATES OF A BALLISTIC MISSILE

V. A. Di Dio Aug. 1963 7 p

(Contract AF 33(600)-29852)

(ESD-TDR-63-163; W-5329; AD-415036)

This computer program investigates the ability of a specified radar to intercept defined trajectories. The radar is specified by its position, scan pattern, and range. This is done by the user in a FORTRAN subroutine permitting consideration of any scan pattern that is definable in terms of range, elevation, and azimuth. The trajectories are defined by their launch and impact points plus either impact angle or time of flight. Once the ballistic parameters have been computed from the input, the trajectory is investigated at successive points along its path, the spacing between points being a function of the eccentric anomaly and dependent upon an input parameter. Whenever the vector from the radar location to the trajectory satisfies the scan pattern of the radar, the position and velocity coordinates of the missile are computed. Author

N64-13144 European Atomic Energy Community, Brussels (Belgium)

TABLES OF EXPONENTIAL MOMENTS [TABLES DE MOMENTS EXPONENTIELS]

R. Nicks and C. Pleinevaux Joint Nucl. Res. Center, Ispra Estab. (Italy), Oct. 1963 10 p In FRENCH; ENGLISH Summary (EUR-462.f) Available from Belgian American Bank and Trust Co., N.Y. Account No. 121.86; 25 Belg. Fr.

In the calculation of radiation propagation, the expression $\int_o^1 f(x)\theta^{-\beta x}dx$ is encountered frequently. The evaluation of this integral can be developed in the series $\int_o^1 f(x)\ \theta^{-\beta x}dx = \Sigma_n\ a_n \int_o^1 x^n\ \theta^{-\beta x}dx$. The expression $I_n = \int_o^1 x^n\ \theta^{-\beta x}dx$ is called the exponential moment. This is the function of β defined as an integral. A table gives exponential moments up to the 15th order for values of the variable ranging from 0 to 12. E.K.R.

N64-13156 Oak Ridge National Lab., Tenn. Physics Div.

TABLES OF FERMI INTEGRALS AND THE MULTIPOLE MOMENTS OF A ROUNDED CHARGE DISTRIBUTION

L. W. Owen and G. R. Satchler 13 Jan. 1964 49 p refs

(Contract W-7405 - eng-26)

(ORNL-3525) OTS: $1.25

Tables of numerical values are given for the integrals $\int t^n f(t)dt$, $\int t^n\ (df/dt)dt$, and $\int t^n(df^2/dt^2)dt$ over the Fermi function $f(t) = [1 + \exp(t-k)]^{-1}$. They are presented in a form suitable for use in evaluating the various multipole moments of the rounded charge distributions of nuclei, both explicitly and in terms of the radii of "equivalent" uniform distributions which have the same moments. Analytic expressions for the integrals are discussed. Author

N64-13190* Maryland U., College Park Computer Science Center

ON SIEVES AND PRIMES

Sigekatu Kuroda and John Maryak Oct. 1963 14 p
(NASA Grant NsG-398; NSF Grant P-1837)
(NASA CR-55161; Tech. Rept. 63-2) OTS: $1.60 ph, $0.80 mf

A sieve routine for an IBM-7090 computer and its application to the generation of primes for an Eratosthenes sieve is presented. Flow charts for the sieve and the subroutine for storing primes, and the machine results are included. J.E.T.

N64-13196 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
FREE VIBRATIONS OF DISCRETE STRUCTURES WITH NONDIAGONAL SYMMETRIC MASS MATRIX
Sandra M. Barondess, Robert J. Jirka, and Senol Utku 1 Mar. 1963 26 p refs
(NASA Contract NAS7-100)
(NASA CR-55215; JPL-TM-33-116) OTS: $2.60 ph, $0.98 mf

The linear eigenvalue problem resulting from the free vibrations of an n-deg of freedom system is in the form $[K]\{x\} = \omega^2[M_s]\{x\}$ where $[K]$ is the stiffness matrix, $[M_s]$ the mass matrix, and ω the natural frequency. By suitable transformation this problem is reduced to the standard form $A\{x\} = \lambda\{x\}$ and by successive rotations (Jacobi's method) $[A]$ is diagonalized to yield the eigenvalues (squares of the natural frequencies) and the associated eigenvectors (the natural modes of vibrations). A digital computer program was developed to give the eigenvalues and the eigenvectors of the original problem. Author

N64-13233 Sandia Corp., Alburquerque, N. Mex.
THE SANDIA APAR-3G SYSTEM: AUTOMATIC PROGRAMMING, RECORDING, AND CONTROL FOR DEVELOPMENT AND PRODUCTION TESTING
R. W. Roberts Dec. 1963 33 p refs
(SC-4944(RR)) OTS: $0.75

The APAR-3G system is an automatic programing, controlling, and recording machine which is readily adaptable to a wide variety of automated data acquisition and control system applications. It is physically and logically modular to permit the assembly of minimum or maximum capability machines. This system can perform the necessary acquisition and control in a typical factory environment and can generate an output (for data reduction) which is compatible with available computer systems. Author

N64-13235 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
THE RELATION BETWEEN THE STABILITY OF FORCED AND UNFORCED LINEAR SYSTEMS
Eliezer Kreindler Sep. 1963 15 p refs
(RN-169)

This report presents sufficient conditions under which the stability of a linear time-varying system, in terms of bounded inputs and outputs, implies, and is implied by, the exponential stability of the unforced system. A heuristic discussion precedes the formal proof. I.v.L.

N64-13244 Research Analysis Corp., Washington, D.C.
PROGRAMMING UNDER NONLINEAR CONSTRAINTS BY UNCONSTRAINED MINIMIZATION: A PRIMAL-DUAL METHOD
Anthony V. Fiacco and Garth P. Mc Cormick Sep. 1963 74 p refs
(Contract DA-44-188-ARO-1)
RAC-TP-96; AD-423903)

A description is given for the theoretical and computational aspects of a method for determining a vector x that yields the minimum of a given function f (x) subject to a collection of side conditions, g_i (x) O, where i = 1, 2,...m, which is a general statement of the mathematical programing problem. The method is proved valid under a specified set of restrictions, and it is concluded to be highly competitive with the currently known techniques for solving nonlinear programing problems. C.L.W.

N64-13245 Stanford U., Calif. Inst. for Mathematical Studies in the Social Sciences
A SIMPLIFIED VERSION OF DANTZIG'S QUADRATIC PROGRAMMING ALGORITHM FOR SOLUTIONS USING A MEDIUM-SIZED DIGITAL COMPUTER
Roy E. Murphy 31 Oct. 1963 25 p refs
(Contract Nonr-225(50))
(Tech. Rept. 125; AD-423332)

This paper suggests that where the optimal use of limited resources, when constant returns to scale cannot be assumed, is a major concern in the operation theory of a business firm, the use of quadratic programing is a practical answer to the problem. A description is presented of a modified Dantzig quadratic program that can be used on medium-sized digital computers. A FORTRAN digital-computer program is also presented, with instructions for its use, as well as a practical example. P.V.E.

N64-13284* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
CONTINUOUS ESTIMATION OF SEQUENTIALLY CORRELATED RANDOM VARIABLES
C. G. Pfeiffer 30 Oct. 1963 21 p refs
(NASA Contract NAS7-100)
(NASA CR-53016; JPL-TR-32-524) OTS: $2.60 ph, $0.83 mf

The concept of a stochastic process is discussed, and sequential correlation is defined. Equations are presented for obtaining the minimum variance estimate of the state of the process when given linearly related data sampled at discrete times. These results are extended to the continuous case, yielding a linear differential equation for the time-varying estimate. This equation is solved to obtain an integral representation of the estimate. An application of the estimation technique is developed. Author

N64-13286* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ASTRONAUTICS INFORMATION: CLASSIFICATION OF SPACES SUPPORTING GRAVITATIONAL FIELDS
A. Z. Petrov 1 Oct. 1963 29 p refs Transl. into ENGLISH from Sci. Trans. Kazan State U., Jubilee (1804-1954) Collection, v. 114, book 8, 1954
(NASA Contract NAS7-100)
(NASA CR-53026; JPLAI/TRANS-29) OTS: $2.60 ph, $1.07 mf

An expanded proof is given of previously derived results concerning the classification of spaces supporting gravitational fields. A vector, V_4, supporting a gravitational field is treated, and a classification scheme for it is established by investigating the algebraic structure of the curvature tensor. C.L.W.

N64-13298 Joint Publications Research Service, Washington, D.C.
THE ARRANGEMENT OF INTERMEDIATE INFORMATION WHEN COMPUTING ON NONERASING TURING MACHINES

N. V. Belyakin 3 Jan. 1964 7 p refs Transl. into ENGLISH of an article from Dokl. Akad. Nauk SSSR (Moscow), v. 152, no. 1, 1963 p 75–77
(JPRS-22608; OTS-64-21212) OTS: $0.50

The problem under investigation was the organization of computations so that a definite portion of the (machine) tape could be used for locating intermediate results without containing either input or output information. The set of cells of the tape is divided into two recursive subsets C, C', which are called rough copy and finished copy, respectively. The recursive set C is called, universally, rough copy with respect to alphabets A, B, if for any general recursive operator with input alphabet A and output alphabet B there exists a machine from the class M(A,B) which computes this operator with rough copy C. The necessary and sufficient conditions for a recursive set to be universal rough copy are discussed. R.T.K.

N64-13356 Aeronautical Research Council (Gt. Brit.)
ON OBTAINING SOLUTIONS TO THE NAVIER-STOKES EQUATIONS WITH AUTOMATIC DIGITAL COMPUTERS
D. B. Russell (Oxford U.) London, HMSO, 1963 41 p refs (ARC-R&M-3331; supersedes ARC-23797) Available from HMSO: 16s

The relative merits of various finite-difference formulae are discussed, as well as the methods used to solve these equations. An investigation is made of all the simpler iterative methods. Author

N64-13366 Stanford U., Calif. Stanford Linear Accelerator Center
ON N-DIMENSIONAL TAYLOR AND LAGRANGE OPERATORS
K. G. Dedrick (Stanford Res. Inst.) and E. L. Chu Nov. 1963 35 p refs
(Contract AT(04-3)-400)
(SLAC-22) OTS: $0.75

The reciprocal nature of the Taylor and Lagrange theorems suggested that relations can be written between the Jacobian and the Taylor and Lagrange differential operators; these relations were established. The definitions of the Taylor and the Lagrange operators given were based on the coordinate transformation defined by the displacement vector (the displacement vector was defined as the difference between the perturbed position and the corresponding unperturbed position of a material point). Since the concept of the displacement vector was readily extended to N-dimensions, the N-dimensional problem was considered throughout the investigations. The following topics were discussed: (1) transformation of coordinates and the Jacobian; (2) Taylor's theorem and the Taylor operator; (3) Lagrange's theorem and the Lagrange operator; (4) the fundamental relation between the Lagrange and the Taylor operators; (5) other relations satisfied by the Taylor and Lagrange operators; and (6) applications. R.T.K.

N64-13371 Space Technology Lab., Inc., Redondo Beach, Calif.
THE RELIABILITY OF ITEMS IN SEQUENCE WITH SENSING, SWITCHING, AND SHELF LIFE FAILURES
Leo A. Aroian 1 Oct. 1963 10 p refs
(Rept. 6121-7531-TU-000)

This report solves the problem of two items, A and B, in sequence with a sensing and switching mechanism, S, when B fails due to shelf life while A is operating. If A fails, S senses this failure, applies power to B which takes over the same function of A. This report corrects and amplifies the previous results for the case of B failing while inoperative. Author

N64-13388 Iowa State U. of Science and Tech., Ames Lab.
POGO REFERENCE MANUAL
D. R. Fitzwater, E. H. Hietbrink, M. M. Ledet, D. E. Mc Farland, and C. E. Runge Nov. 1963 54 p
(Contract W-7405-eng-82)
(IS-769) OTS: $1.25

This programers' manual for POGO supplies the necessary background information for the use of the various system functions, as well as program descriptions for each system function, and examples of their use. Author

N64-13398 Argonne National Lab., Ill.
A PRIMER ON THE ACT-III COMPILER FOR THE LGP-30 DIGITAL COMPUTER
H. C. Thacher, Jr., and R. E. Grench Oct. 1963 96 p
(Contract W-31-109-eng-38)
(ANL-6697)

Instructions for writing programs for the ACT-III compiler for the LGP-30 computer are presented in textbook form, including exercises. Procedures for translating and solving problems by using the programs are also included. P.V.E.

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-12426 Columbia U., Palisades, N.Y. Lamont Geological Observatory
GEOPHYSICAL INVESTIGATION OF ARCTIC ICE PACK Final Report [15 Sep. 1960–31 May 1963]
Henry W. Kutschale and William R. Farrand 30 Jun. 1963 59 p refs
(Contract AF 19(604)-7442)
(AFCRL 63-693; AD-424699)

CONTENTS:

1. GEOPHYSICAL INVESTIGATION OF ARCTIC ICE PACK H. W. Kutschale p 1–14 refs (See N64-12427 04-21)
2. ICE AGE STUDIES W. R. Farrand p 15–16 (See N64-12428 04-21)
3. POSTGLACIAL UPLIFT W. R. Farrand p 17–28 (See N64-12429 04-21)
4. PLEISTOCENE SEA LEVELS W. R. Farrand p 29–46 refs (See N64-12430 04-21)
5. AGE OF THE TWO CREEKS FOREST BED W. R. Farrand p 46–53 refs (See N64-12431 04-21)

N64-12427 Columbia U., Palisades, N.Y. Lamont Geological Observatory
GEOPHYSICAL INVESTIGATION OF ARCTIC ICE PACK
Henry W. Kutschale *In its* Geophys. Invest. of Arctic Ice Pack Final Rept. 30 Jun. 1963 p 1–14 refs (See N64-12426 04-21)

Experiments were made on shallow-water sound propagation on the Arctic continental shelf. The waves were successfully interpreted in terms of normal-mode theory for an ice-water-sediment acoustic system. Current measurements made on Station Alpha in the central Arctic Ocean show a clockwise spiral which is not as pronounced as the Ekman spiral for homogeneous water. The residual currents are primarily induced by

frictional stress of the ice on the water. Ice oscillations, tides, and storm surges were investigated in detail. The spectral peak due to sea and swell is absent in the Arctic Ocean. Dispersion of earthquake surface waves propagating across the central Arctic Ocean indicates an oceanic structure with crustal thickness between 6 and 15 km. Measurements of the total magnetic intensity at a grounded ice station commonly show daily fluctuations of several hundred gammas amplitude. Author

N64-12428 Columbia U., Palisades, N.Y. Lamont Geological Observatory
ICE-AGES STUDIES
W. R. Farrand *In its* Geophys. Invest. of Arctic Ice Pack Final Rept. 30 June 1963 p 15–16 (See N64-12426 04-21)

Curves of postglacial rebound have been prepared for the Great Lakes region and for arctic Canada. They show that the rate of rebound decreases rapidly from the time of local deglaciation toward the present. Moreover, for a given moment of time, uplift is proceeding at a greater rate in localities nearer to the former ice center. A map has been compiled showing the extent of northern hemisphere ice sheets at the time of maximum (penultimate) glaciation, the last glaciation, and a retreatal border of 11,700 years ago. From this map and from average thicknesses of present day ice sheets, a calculation of Pleistocene ice volumes and concomitant sea level lowering has been made. Sea level was lowered about 137 to 159 meters at the height of the penultimate glaciation and lowered about 105 to 123 meters during the last glaciation. Author

N64-12429 Columbia U., Palisades, N.Y. Lamont Geological Observatory
POSTGLACIAL UPLIFT
W. R. Farrand *In its* Geophys. Invest. of Arctic Ice Pack Final Rept. 30 Jun. 1963 p 17–28 (See N64-12426 04-21)

The differential uplift of beaches formed around lakes in front of the retreating ice sheets of the last glaciation is discussed. Attention was directed towards the Great Lakes region of North America and the Baltic area of northern Europe where the abandoned shorelines of extinct water bodies rise progressively toward the former ice centers. The uplift of these shorelines, with the respect to time, was studied and the use of isobase maps to study postglacial uplift is discussed. Finally, an interpretation of postglacial uplift is given. C.L.W.

N64-12430 Columbia U., Palisades, N.Y. Lamont Geological Observatory
PLEISTOCENE SEA LEVELS
W. R. Farrand *In its* Geophys. Invest. of Arctic Ice Pack Final Rept. 30 Jun. 1963 p 29–46 refs (See N64-12426 04-21)

A discussion is presented concerning the estimation of Pleistocene ice volumes and subsequent comparison with independent data on sea-level lowering. Minimum sea levels are included along with the geological evidence of sea-level lowering. Eustatic sea-level curves, ice reduction curves, and oceanic terrestrial temperature curves are also given. From a comparison of the data, eustatic sea-level curves and ice reduction curves match well, but the oceanic and terrestrial temperatures show differences. Comparing the sequence of change of ocean temperature, ice reduction, and sea level, no significant change was observed in oceanic nor terrestrial temperature until 50% to 60% of the ice had disappeared. C.L.W.

N64-12431 Columbia U., Palisades, N.Y. Lamont Geological Observatory
AGE OF THE TWO CREEKS FOREST BED
W. R. Farrand *In its* Geophys. Invest. of Arctic Ice Pack Final Rept. 30 Jun. 1963 p 46–53 refs (See N64-12426 04-21)

The Two Creeks forest bed located in northeastern Wisconsin was studied in terms of age, the sequence of its flooding, and its burial by glacial ice. New data of 11,840 years for the Two Creeks forest bed strongly refute the correlation of that forest with the Alleröd warm phase of Europe. At the same time, it suggests the possibility of correlation with the earlier Bölling warm phase. Similarly, the new data strengthen some and refute other correlations throughout central and eastern North America. C.L.W.

N64-12616 Massachusetts Inst. of Tech., Cambridge
INDIRECT MEASUREMENT OF THE MEAN MERIDIONAL CIRCULATION IN THE SOUTHERN HEMISPHERE Scientific Report No. 3
Peter A. Gilman and Victor P. Starr 1 Nov. 1963 55 p refs (Contract AF 19(628)-2408; Planetary Circulations Proj.) (AFCRL-63-763; AD-425861)

Using IGY data analyses of Obasi (1963), the mean meridional circulations for the southern hemisphere are measured indirectly, using the method of characteristics. It is found that the slope of the characteristic curves is proportional to the ratio of the zonal vertical wind shear to the dynamic stability. The characteristic curves may be approximately identified with the curves of constant absolute angular momentum. The horizontal and vertical momentum convergences enter as forcing functions. Vertical eddy convergences of momentum in the "free" atmosphere are calculated using the directly measured mean meridional circulations. Large areas of negative eddy viscosity result, always in a region including the midlatitude jet. Similar calculations for the northern hemisphere using data of Buch (1954) give the same general result. The negative signs do not appear to be implausible if large scale vertical eddies dominate at higher levels, but the magnitudes may be too large. Author

N64-12667 Cornell U., Ithaca, N.Y. Agricultural Research Service
THE ENERGY BUDGET AT THE EARTH'S SURFACE. AN EXPERIMENTAL STUDY OF AIR FLOW IN A CORN PLANT-AIR LAYER
Zenbei Uchijima and James L. Wright Jul. 1963 76 p refs Presented at the 5th Conf. on Agr. Meteor., Lakeland, Fla., 4 Apr. 1963
(USAEPG Cross Service Order 2–63)
(Interim Rept. 63–1; Res. Rept. 367; AD-424162)

Data are processed to provide the characteristics of airflow in the corn plant-air layer. From wind velocity measurements at 130-, 110-, 90-, and 50-cm heights, the shearing stress, friction velocity, exchange coefficient, and mixing length are calculated for the respective heights. The data indicate that the height dependence of shearing stress, friction velocity, and exchange coefficient can be expressed as an exponential function of height. Near the ground, the mixing length increased linearly with increment of height above the ground (constant of proportionality = 0.4). Author

N64-12785 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS FROM METEOROLOGIYA I GIDROLOGIYA (METEOROLOGY AND HYDROLOGY) [MOSCOW] NO. 5, 1963
V. N. Barakhtin et al 12 Jul. 1963 116 p refs Transl. into ENGLISH of 11 articles p 3–13, 22–27, 29–31, 38–50, 56–59, and 61–63
(JPRS-20146; OTS-63-31267) OTS: $2.50

CONTENTS:

1. SOME PECULIARITIES OF THE AIRPLANE BUFFETING ZONE AT ALTITUDES OF 8–10 KM V. N. Barakhtin p 1–14 refs (See N64-12786 04-21)

2. FLUCTUATIONS IN THE HEIGHT OF CLOUD BASES M. V. Rubinshteyn p 15–27 refs (See N64-12787 04-21)

3. SOME PECULIARITIES OF CUMULONIMBUS CLOUD FORMATION AND FLIGHT CONDITION NEAR THEM B. Ye. Peskov p 28–43 refs (See N64-12788 04-21)

4. DETERMINING LOW SAFE FLIGHT ALTITUDE ACCORDING TO VERTICAL ATMOSPHERIC SOUNDING DATA M. M. Butorin p 44–49 (See N64-12789 04-21)

5. EXPEDIENCY OF ARTIFICIAL INTENSIFICATION OF THE MELTING OF SNOW IN THE MOUNTAINS OF CENTRAL ASIA V. L. Shul'ts p 50–61 refs (See N64-21790 04-21)

6. EXPERIENCE IN REFINING THE FORECASTING OF LOW CLOUDINESS, POOR VISIBILITY, AND FOG D. N. Lavrishchev p 62–71 (See N64-12791 04-21)

7. PRINCIPAL CHARACTERISTICS AND TRENDS IN THE DEVELOPMENT OF MODERN INSTRUMENTS FOR MEASURING THE HEIGHT OF CLOUD BASES N. S. Bozhevikov and L. A. Shestopalov p 72–87 refs (See N64-12792 04-21)

8. SOVIET EXPEDITIONS TO THE ANTARCTIC, 1959–1961 V. A. Bugayev p 88–91 ref

9. LITERATURE IN METEOROLOGY AND HYDROLOGY DURING 1962 p 92–102 refs

10. IN THE MAIN ADMINISTRATION OF THE HYDROMETEOROLOGICAL SERVICE p 103–106 refs

11. IN THE INSTITUTIONS OF THE HYDROMETEOROLOGICAL SERVICE p 107–112 refs

N64-12786 Joint Publications Research Service, Washington, D.C.

SOME PECULIARITIES OF THE AIRPLANE BUFFETING ZONE AT ALTITUDES OF 8-10 KM

V. N. Barakhtin *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 1–14 refs (See N64-12785 04-21) OTS: $2.50

An analysis of atmospheric turbulence from accelerogram data is made of 131 zones of moderate and severe buffeting on the Moscow–Irkutsk air route. The maximum increment of overload in each of the zones was not less than 0.3 g. In addition, the aerosynoptic conditions of a large number of flights on days when no buffeting was observed were also analyzed. Results are presented in graphical and tabular form. J.E.T.

N64-12787 Joint Publications Research Service, Washington, D.C.

FLUCTUATIONS IN THE HEIGHT OF CLOUD BASES

M. V. Rubinshteyn *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 15–27 refs (See N64-12785 04-21) OTS: $2.50

Tabular data are presented for the variability of cloud base height for short time periods with continuous recording. Specific tables include: (1) recurrence (in %) of the variability in time of the heights of cloud bases; (2) recurrence (in %) of variability in time of cloud base height for periods with considerable and small fluctuations; and (3) recurrence of differences in the simultaneous calculation of the height of cloudiness at two points 500 meters apart. Time intervals vary from 1 to 20 minutes. J.E.T.

N64-12788 Joint Publications Research Service, Washington, D.C.

SOME PECULIARITIES OF CUMULONIMBUS CLOUD FORMATION AND FLIGHT CONDITION NEAR THEM

B. Ye. Peskov *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 28–43 refs (See N64-12785 04-21) OTS: $2.50

Tabular results and methods of investigation are presented for 73 Soviet flights over European U.S.S.R. and the Far East for the determination of meteorological conditions of flight in the upper-half of the troposphere in the near vicinity of cumulonimbus clouds. Tables included concern: (1) recurrence (in %) of cloudiness of various types; (2) some characteristics of convective cloudiness; (3) the vertical development of Cb clouds depending on the energy of instability and moisture content; and (4) the vertical development of Cb clouds for various totals of dew-point deficits and for a distance in both directions from a front of less than and more than 300 km. J.E.T.

N64-12789 Joint Publications Research Service, Washington, D.C.

DETERMINING LOW SAFE FLIGHT ALTITUDE ACCORDING TO VERTICAL ATMOSPHERIC SOUNDING DATA

M. M. Butorin *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 44–49 (See N64-12785 04-21) OTS: $2.50

Suggestions are presented for using vertical atmospheric temperature and pressure data to help determine flight routes and spacings over flat or mountainous terrain. J.E.T.

N64-12790 Joint Publications Research Service, Washington, D.C.

EXPEDIENCY OF ARTIFICIAL INTENSIFICATION OF THE MELTING OF SNOW IN THE MOUNTAINS OF CENTRAL ASIA

V. L. Shul'ts *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 50–61 refs (See N64-12785 04-21) OTS: $2.50

The feasibility of using coal dust, carbon black, or other substances to enhance the melting of mountainous ice or snow or glacial ice is examined and rejected. Ostensibly, the water gained would be used for irrigation. However, it is shown that actual and theoretical effects of blackening have little resemblance. J.E.T.

N64-12791 Joint Publications Research Service, Washington, D.C.

EXPERIENCE IN REFINING THE FORECASTING OF LOW CLOUDINESS, POOR VISIBILITY, AND FOG

D. N. Lavrishchev *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 62–71 (See N64-12785 04-21) OTS: $2.50

Three graphs are presented as aids in the forecasting of low cloudiness, poor visibility, and fog. Graph 1 shows the relationship of the height of low cloudiness to the air temperature (T) and the vapor tension (e) in millibars at the surface of the earth. This graph shows that a change in the height of unbroken low cloudiness has the same appearance as a change in the maximum vapor tension at the surface of the earth. Graph 2 shows the relationship of the height of low cloudiness (H) and horizontal visibility (V) to the dewpoint deficit ($T - T_d$) at the surface of the earth. This graph is used mainly to forecast possible minimum values of the height of cloudiness and the horizontal visibility at a given airport. Graph 3 shows the occurrence of fog (radiation and advection) in relationship

to the temperature (T) and vapor tension (e). This graph makes it possible to determine fog formation and the time of the formation. Criteria for the construction of the graphs and an analysis for usage of the graphs are included. J.E.T.

N64-12792 Joint Publications Research Service, Washington, D.C.
PRINCIPAL CHARACTERISTICS AND TRENDS IN THE DEVELOPMENT OF MODERN INSTRUMENTS FOR MEASURING THE HEIGHT OF CLOUD BASES
N. S. Bozhevikov and L. A. Shestopalov *In its* Transl. from Meteorol. i Gidrolog. [Moscow] no. 5, 1963 12 Jul. 1963 p 72–87 refs (See N64-12875 04-21) OTS: $2.50

The basic characteristics and operating features of light impulse (light locator) and trigonometric devices for measuring the height of cloud bases are discussed. The design and function of the principal components and an error analysis of actual cloud base measurements are included. J.E.T.

N64-12834 American Meteorological Society, Boston, Mass.
STUDIES CONDUCTED AT THE CENTRAL AEROLOGICAL OBSERVATORY ON THE ARTIFICIAL MODIFICATION OF CLOUDS AND FOGS [OB ISSLEDOVANIIAKH, PROVEDENNYKH V TSENTRAL'NOL AEROLOGICHESKOI OBSERVATORII V OBLASTI ISKUSSTVENNYKH VOZDEISTVII NA OBLAKA I TUMANY
I. I. Gaivoronskii Bedford, Mass. AFCRL Mar. 1963 29 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 26, 1959 p 39–55
(Contract AF 19(604)-6113)
(T-R-401; AD-422335)

The following areas are discussed with respect to modification of clouds and fogs: (1) theoretical studies; (2) experiments using dry ice; (3) study of some problems of modification techniques; (4) new devices for modifying clouds and fogs—airborne automatic dispensing device and ground-based carbon dioxide apparatus; (5) experiments in modifying thick cumulus clouds; and (6) use of AgI and PbI_2 as reagents for modifying clouds and fogs. P.V.E.

N64-12878* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF ERRORS IN THE GEOGRAPHIC REFERENCING OF NIMBUS CLOUD PICTURES
Eugene M. Darling, Jr. Washington, NASA, Jan. 1964 27 p refs
(NASA TN D-2137) OTS: $0.75

Errors in the determination of satellite attitude from telemetered data are expected to cause a maximum overall error of 50 nmi. in the geographical referencing of Nimbus A cloud pictures. This error is tolerable for most operational purposes. Author

N64-12900 National Weather Satellite Center, Washington, D.C.
CATALOGUE OF TIROS V AND VI CLOUD PHOTOGRAPHY FOR MAY 1963: TIROS V (PASSES 4529 THRU 4720), TIROS VI (PASSES 3281 THRU 3723)
Aug. 1963 52 p

Maps and tabulated listings, which give descriptive information about the pictures obtained by TIROS V and TIROS VI, are presented. In the listings, each picture sequence is described by one line, and for each station the sequences are listed in the order in which they appear on the film reel. I.v.L.

N64-12903 Joint Publications Research Service, Washington, D.C.
FORECASTING ATMOSPHERIC PRESSURE FIELDS USING EQUATIONS OF HYDRODYNAMICS
V. M. Berezin 8 Jan. 1964 10 p refs Transl. into ENGLISH from Vestnik Mosk. Univ., Ser. III, Fiz. -Astron. (Moscow), no. 5, 1963 p 28–33
(JPRS-22646; OTS-64-21229) OTS: $0.50

The solution of the problem is found in a limited space. In this connection, use is made of the geostrophic approximation, and the basic flow is introduced. In actuality, the problem for an equation of the S.L. Sobolev type is solved using the method of separation of variables. Author

N64-13206 Meteorology International Inc., Monterey, Calif.
THE INITIAL-FIELDS SPECIFICATION PROBLEM Technical Summary Report
Manfred M. Holl Jun. 1963 19 p refs
(LRL Order 3894105)

The evolution of the state of the atmosphere and its circulation phenomena may be simulated by the integration in time of mathematical models of the atmosphere, which are based on the formulations of the governing mechanisms and processes. In applying a dynamical-mathematical model to the problem of predicting the subsequent evolution of the atmosphere, following the state at a designated initial moment in time, the specification of the initial distributions of the atmospheric variables, in the completeness demanded by the formulated governing model, is required. This report presents the development of a technique for organizing the initial data so as to minimize resulting extraneous disturbances such as compression-gravity waves. The organization of the initial data is complicated and interwoven with the question of information content in the available data from which the initial state is to be constructed. I.v.L.

N64-13227 Joint Publications Research Service, Washington, D.C.
TENTATIVE METHOD FOR CALCULATIONS OF THE DISPERSION OF DISCHARGES IN THE ATMOSPHERE
3 Jan. 1964 8 p Transl. into ENGLISH of an article from Byul. Stroit. Tekh. (Moscow), no. 11, Nov. 1963 p 29–31
(JPRS-22598; OTS-64-21206) OTS: $0.50

A procedure is discussed for calculating the dispersion, in the atmosphere, of the discharges of smokestacks of electric powerplants in order to determine the necessary height of the stacks and to standardize the discharges. The procedure also presents a method for determining the concentrations of impurities at a dangerous wind velocity, at various distances from the stack, as well as the ash concentration. A method for calculating the maximum concentration for electric powerplants, with stacks of various heights and various discharge parameters, is also presented. I.v.L.

N64-13228 Joint Publications Research Service, Washington, D.C.
SOVIET REVIEW OF WEATHER MODIFICATION TECHNIQUES
M. Zaiko 3 Jan. 1964 8 p Transl. into ENGLISH of an article from Grazhdanskaya Aviatsiya (Moscow), no. 11, Nov. 1963 p 22–23
(JPRS-22609; OTS-64-21213) OTS: $0.50

A brief summary of techniques dealing with modification of clouds and fogs for the purpose of dissipating these formations is presented. P.V.E.

N64-13299 Joint Publications Research Service, Washington, D.C.
CONTRIBUTION TO EXPERIMENTAL DETERMINATION OF DIFFUSION PARAMETERS OF GASES IN THE ATMOSPHERE
L. Nemec 16 Jan. 1964 10 p refs Transl. into ENGLISH of an article from Meteorologicke Zpravy (Prague), v. 16, no. 3–4, 31 Aug. 1963 p 66–68
(JPRS-22767; OTS-64-21309) OTS: $0.50

Ground-level concentration of gases which come from an elevated source above ground depends on the parameters of the emission of the gas, on the parameters of the circulation of the air and of the turbulence diffusion, as well as on the position on the ground in relation to the source. In order to express the relations among these parameters, Sutton's model of dispersion was worked out for various meteorological situations. R.T.K.

N64-13321* National Aeronautics and Space Administration, Washington, D.C.
AN INVESTIGATION OF THE RELATION AMONG SOME OF THE STATISTICS FOR UPPER-AIR PRESSURE, TEMPERATURE AND DENSITY
Charles P. Wood and William C. Spreen (Air Weather Serv., Offutt AFB) Repr. from J. Appl. Meteorol., v. 2, no. 2, Apr. 1963 p 292–297 refs
(NASA RP-114)

From analytical and empirical calculations with upper-air pressure, temperature, density, and height, it is concluded that: (1) mean density can be estimated closely from mean pressure and temperature; (2) the standard deviation of density can be estimated from mean pressure and temperature and the standard deviation of temperature; (3) the correlation of temperature at two pressure surfaces is a very good estimate of the correlation of density at these two surfaces, but a similar relation does not exist at two constant height surfaces; (4) a linear relation exists between the standard deviation of height of a pressure surface and the standard deviation of pressure at a height equal to the mean height of the pressure surface; (5) there is also some relationship between the correlation of the heights of two pressure surfaces and the correlation of pressures at the monthly mean heights of the pressure surfaces. Author

N64-13323 National Aeronautical Lab., Bangalore (India)
A STUDY OF THE HOURLY WIND SPEEDS AT AMRITSAR FROM THE POINT OF VIEW OF WIND POWER UTILIZATION
D. V. L. N. Rao and K. N. Narasimhaswamy Apr. 1963 25 p ref
(TN-WP-24-63)

Frequencies of different wind speeds and cumulative frequencies were computed to determine the energy extractable from the wind by a machine with an overall power coefficient of 12 percent and 30 m^2 swept area. The annual energy works out to 984 kwh. The quantity of water that can be pumped on each day of a typical year was computed; the annual quantity is 31,000 kl (68,200,000 gal) of water pumped by a windmill of overall power coefficient of 12 percent and swept area of 23.6 m^2. Author

N64-13345 National Aeronautical Lab., Bangalore (India)
A STUDY OF HOURLY WIND SPEEDS AT BHOPAL FROM THE POINT OF VIEW OF WIND POWER UTILIZATION
M. S. Prakasa Rao Apr. 1963 21 p ref
(TN-WP-23-63)

Frequencies and cumulative frequencies have been worked out and used to estimate the amount of energy extractable from the wind under certain assumptions. Durations of spells of low wind (less than 8 km/hr) and the diurnal variation of wind have also been discussed. The yearly average wind speed at Bhopal is 11 km/hr. The annual energy output is 1,370 kwh for a wind electric generator with an overall power coefficient of 12 percent. The annual water pumping capacity of a WP-2-type windmill is estimated at about 42,000 kl (9,240,000 gal). Author

N64-13346 National Aeronautical Lab., Bangalore (India)
A STUDY OF THE HOURLY WIND SPEEDS AT JAIPUR FROM THE POINT OF VIEW OF WIND POWER UTILIZATION
M. S. Prakasa Rao and S. R. Radhakrishnan Apr. 1963 19 p refs
(TN-WP-25-63)

Certain characteristics of wind, such as frequency distribution, spells of low winds, and the diurnal variation are discussed. The annual energy output of an aerogenerator of 30 m^2 swept area and an overall power coefficient of 12 percent is estimated at 561 kwh. The annual water pumping capacity of a direct-acting windmill with the same overall power coefficient, but with a swept area of 23.6 m^2 (WP-2-type windmill), is estimated at about 17,550 kl (3,861,000 gal), i.e., 10,580 gal/day. The annual mean wind speed is 7 km/hr. Author

N64-13352 Joint Publications Research Service, Washington, D.C.
METHODS OF CLIMATE CONTROL
Nikolay Petrovich and Liya Abramovna Flit 17 Jan. 1964 96 p Transl. into ENGLISH of the Foreword and Ch. 4–6 from the book "Chelovek menyayet klimat", Moscow, Sov. Rossiya Publishing House, 1962 p 5–9 and 49–129
(JPRS-22798; OTS-64-21333) OTS: $2.55

The following topics are discussed: (1) the law of conservation of energy and the climate, (2) control of direct and scattered radiation, (3) control of reflected solar radiation, (4) control of the thermal radiation of the earth and its atmosphere, (5) control of the heat of the earth's surface, (6) water heating of the earth, and (7) developments in the science of weather forecasting. R.T.K.

N64-13374* Southwest Center for Advanced Studies, Dallas, Tex.
ATMOSPHERIC TIDES AND ASSOCIATED MAGNETIC EFFECTS
J. A. Fejer 11 Oct. 1963 68 p refs Submitted for Publication
(NASA Grant NsG-269-62)
(NASA CR-55160) OTS: $6.60 ph, $2.24 mf

The dynamical theory of atmospheric tides and its relation to observations on the ground and in the upper atmosphere are reviewed briefly. The lunar tidal oscillations of atmospheric pressure observed on the ground are thought to be almost entirely due to gravitational forces whereas the solar tidal oscillations are believed to be mainly caused by solar heating. The dynamo theory attributes the quiet day variations of the geomagnetic field to tidal oscillations at ionospheric height. The theory has been used either to derive the magnetic variations from an assumed tidal wind system or to derive the tidal wind system for the observed magnetic variations. The results of both types of calculations lend broad support to the dynamo theory although neither of the two approaches is free of arbitrary assumptions. The additional daily magnetic variations observed during magnetically disturbed days are particularly intense in the auroral zone. These variations are believed to be caused by some form of interaction of the solar wind with the geomagnetic field. Various proposed theories of these daily disturbance variations are described, and one of them is discussed in detail. Author

N64-13378 Agricultural Research Service, Temple, Ariz Water Conservation Lab.
SURFACE ENERGY BALANCE IN ARID LANDS AGRICULTURE, 1960-1961
C. H. M. Van Bavel, L. J. Fritschen, and R. J. Reginato Dec. 1963 50 p
(Production Res. Rept. 76)

This report discusses methods and preliminary results of a study of the disposition of radiant energy over bare land that is wetted or ponded, in an arid, hot climate. Evaporative flux at the surface is evaluated from a triplicate precision weighing lysimeter installation. Other methods are conventional. Comparison of small with large evaporating surfaces shows relatively small advective effects at the surface. Over large, wet areas, daily balances show, as a rule, no net extraction of heat from the air. Heat flow into the air is extremely variable during the day, depending on the nature of surface and wind conditions. Author

N64-13379 World Meteorological Organization, Geneva (Switzerland)
THE ADVANCEMENT OF ATMOSPHERIC SCIENCES AND THEIR APPLICATION IN THE LIGHT OF DEVELOPMENTS IN OUTER SPACE Second Report
Jun. 1963 54 p

The Fourth World Meteorological Congress established the general policy of the organization in satellite meteorology for the next 4-year period. Bilateral discussions between the U.S.S.R. and the U.S. were considered, and steps were taken to establish a World Meteorological Organization Advisory Committee. The congress endorsed the concept of an overall world weather service involving the use of conventional and satellite data as well as the establishment of national, regional, and world centers. A list has been made of outstanding problems of the atmospheric sciences; a new development fund has been established; and a planning unit has been approved to assist in the development of the plan for the world weather watch. C.LW.

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-12472 Joint Publications Research Service, Washington, D.C.
A VARIATION PROBLEM IN FLIGHT DYNAMICS
Yu. N. Moiseyev *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci.: Tech. Cybernetics, no. 4, 1963 11 Dec. 1963 p 278-287 refs (See N64-12451 04-01) OTS: $5.00

In this article a method is proposed for the solution of a variation problem in the flight of a motor-driven aircraft to its maximum distance in the atmosphere. The problem is solved by using the maximum principle of L. S. Pontryagin. It is shown that under defined conditions the problem may be reduced to a problem with a free right end trajectory which is solved by reciprocal integration without fitting the boundary values of conjugate functions. A way is also proposed of solving the boundary problem. Author

N64-12712* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF A SOLAR ORIENTATION CONTROL SYSTEM FOR SPACECRAFT
Anthony Fontana, Julian D. Maynard, Marcus L. Brumfield, and Otis J. Parker Washington, NASA, Jan. 1964 50 p refs
(NASA TM X-944) OTS: $1.25

A three-axis solar orientation control system for spacecraft has been designed and built and has been tested both on the ground and in spaceflight to determine its capabilities. The system is simple; it is relatively compact; it has no moving parts other than a relay, solenoid valves, and a single rate gyro; and it is rugged enough to withstand severe environments, both during launch and in space. Silicon solar cells are used in the sensing elements for the pitch- and yaw-control axes, and the controlling torques for pitch, yaw, and roll are generated by simple cold gas, on-off, reaction jets. In general, the flight test results confirmed the predicted capability of the system to efficiently orient any specified axis of a spacecraft toward the center of the solar disk with a limit cycle amplitude of no more than ±3 minutes of arc. Author

N64-13013* Westinghouse Electric Corp., Baltimore, Md. Air Arm Div.
STUDY AND ANALYSIS OF ADVANCED SPACEBORNE DETECTION, TRACKING, AND NAVIGATION SYSTEM. PART II-ANALYTICAL SOLUTION [Final Report]
Apr. 1963 454 p refs
(NASA Contract NASw-460)
(NASA CR-55075) OTS: $23.50 ph, $13.83 mf

Sensor and guidance control methods are selected; sensor measurement accuracies are specified after, and on the basis of, a study and evaluation of the resulting system performance. As a part of the analysis, control and data processing methods and mathematical techniques are considered, selected, and evaluated, and digital programs employed are presented and discussed. Author

N64-13127 General Precision, Inc., Tarrytown, N.Y.
STUDY OF MULTI-FUNCTION SENSORS FOR GUIDANCE SUBSYSTEMS [Final Report, 1 Jul. 1962-30 Jun. 1963]
A. A. Miccioli Wright-Patterson AFB, Ohio, AF Avionics Lab. Dec. 1963 82 p refs
(Contract AF 33(657)-9207)
(RTD-TDR-63-4049; AD-425224)

Experimental and analytical investigations of the extension of the GPL area correlation technique from terrain matching to simultaneous star field and beacon tracking in the context of a space rendezvous mission were conducted. It was indicated that the extension was a feasible one. Simultaneous (dual-mode) star field and beacon tracking was successfully demonstrated in the laboratory. Author

N64-13288* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
CELESTIAL SENSOR ACTIVITIES, JPL, 1 JANUARY 1960 THROUGH 1 JANUARY 1963
G. W. Meisenholder [1963] 85 p refs
(NASA CR-53005) OTS: $8.10 ph, $2.75 mf

A summary is given of the guidance and control celestial sensor development. General specifications are given which cover anticipated requirements for a lunar and planetary horizon scanner prototype that will be useful for Moon, Mars, and Venus orbiters, as well as other missions, and for Voyager terminal guidance. The lunar and planetary horizon scanner provides two-axis local vertical position-error signals and apparent

angular diameter information to be used for range purposes against the following essential objects in the order of their priority: the Moon, Mars, Venus, and Earth. Supporting activities are reported which include a discussion of celestial simulator facilities, the guidance and control subsystems for the first two Ranger flights, and the guidance and control subsystems for the last two Ranger flights. C.L.W.

23 PHYSICS, GENERAL

Includes acoustics; cyrogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-12409 Sandia Corp., Albuquerque, N. Mex.
IMPLICATIONS OF EXPERIMENTAL DATA ON THE SCALING OF CRATER DIMENSIONS
L. J. Vortman *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 38–54 refs (See N64-12407 04-01)

Crater dimension scaling methods do not agree with experimental data over the entire range of burst depths and yields. These methods are inadequate since they describe a complex combination of different cratering mechanisms in a relatively simple manner. Some evidences of the relative importance of the various cratering mechanisms are discussed. Author

N64-12414 General American Transportation Corp., Niles, Ill.
ENERGY DISTRIBUTION IN A HALF-SPACE UNDER NUCLEAR LOADS
G. L. Neidhart and J. B. Harkin *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 124–140 refs (See N64-12407 04-01)
(Contract AF 29(601)-2832)

This paper presents a solution of the elastic half-space problem which will provide insight into the dominant features in which energy is propagated in rock or soil under blast loading. Response to a decelerating load and attenuation with depth due to geometric divergence of the rays of the seismic wave front are two effects revealed. Author

N64-12415 Air Force Systems Command, Kirtland AFB, N Mex.
MEASUREMENT OF ARRIVAL TIMES FOR AIR INDUCED COMPRESSIONAL AND SHEAR WAVES
Harry E. Auld *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 141–150 refs (See N64-12407 04-01)

Experimental data from an omnidirectional peak stress time-of-arrival detector, designed for nuclear tests, are presented in support of a theory which suggests that waves propagating through the earth may, at certain stress levels, have a precursor waveform. Data obtained give clear evidence of an air-induced compression wave and detectable evidence of an air-induced shear wave. Wave velocities and pseudoelastic constants are presented. Author

N64-12417 Mitre Corp., Bedford, Mass
DISPLACEMENT AND ACCELERATION SPECTRA FOR AIR-INDUCED GROUND SHOCK
W. L. Mc Cabe, C. C. Mow, and M. L. Baron *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 169–187 refs (See N64-12407 04-01)

Consideration was given to the ground shock environment for underground structures in the superseismic region in which the air-induced shock effects from a surface burst of a nuclear weapon are predominant. A study of the effects experienced by an underground installation in the high-pressure (500 to 2000 psi) regions was extended, and design information on the shock environment for underground installations in such high-overpressure regions was provided. C.L.W.

N64-12450 European Atomic Energy Community, Brussels (Belgium)
NON DESTRUCTIVE TESTING BY DOUBLE IMPULSE EDDY CURRENT [CONTROLE NON DESTRUCTIF PAR APPAREILLAGE A COURANTS DE FOUCAULT A DOUBLE IMPULSION]
A. Philippe Joint Nucl. Res. Center, Ispra Estab. (Italy), Met. and Ceramics Serv., Oct. 1963 23 p refs Presented at the Journées Mét. d'Automne, Paris, 15–19 Oct. 1962 In FRENCH; ENGLISH summary
(EUR-356.f) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 40 Belg. Fr.

This report tends to show the possibilities offered by the pulses in the nonferrous metallic sheets faults detection field. A graphic relation is shown between the pulse duration of current flowing through the primary coil of a probe and the relative variation in voltage through the secondary coil of the same probe for several variations in thicknesses of a metallic sheet, in order to point out that well-defined pulse durations exist which lead to maximum sensitivity to variations with a given sheet thickness. Author

N64-12475 European Atomic Energy Community, Brussels (Belgium)
DETERMINATION OF TRACE IMPURITIES IN ORGANIC MATERIALS BY NEUTRON ACTIVATION ANALYSIS [DETERMINATION AU MOYEN DE L'ANALYSE PAR ACTIVATION AUX NEUTRONS DES IMPURETES PRESENTES A L'ETAT DE TRACES DANS DES MATERIAUX ORGANIQUES]
F. Girardi and J. Pauly Joint Nucl. Res. Center, Ispra Estab. (Italy), Nucl. Chem. Ser., Oct. 1963 25 p refs Presented at the 19th Cong. of Pure and Appl. Phys., London, 10–17 Jul. 1963 In FRENCH; ENGLISH summary
(EUR-432.f) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 40 Belg. Fr.

Neutron activation analysis has been applied to hydrocarbons and plastics. The impurities detected can be divided into two groups—those homogeneously distributed as organic or metallorganic compounds and those contained as particles in suspension. Inorganic elements generally belong to the first group. The halogens, As and Sb, are determined in a nondestructive manner by gamma ray spectrometry. For oxygen, results have been obtained by using 14 Mev neutrons and measuring the amount of nitrogen-16 produced by (n,p) reaction. For the determination of sulphur different reactions have also been studied and interferences produced by neighboring elements evaluated. Metallic impurities are generally bound to particles in suspension. Many of them can be analyzed by nondestructive methods, but oxidation of the organic compound and chemical separation are often useful to increase selectivity. Procedures in which the results are calculated by means of an electronic computer IBM 7090 have been developed. Author

N64-12476 General Mills, Inc., Minneapolis, Minn.
SPUTTERING YIELDS Annual Report, 1 Nov. 1962-31 Oct. 1963
R. V. Stuart and G. K. Wehner 15 Nov. 1963 72 p refs
(Contract Nonr-1589(15))
(Rept. 2480; AD-424612)

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2. TIME-OF-FLIGHT METHOD OF DETERMINING VELOCITIES OF SPUTTERED ATOMS R. V. Stuart, K. Brower, and W. Mayer p 2 (See N64-12478 04-23)

3. ENERGY DISTRIBUTIONS OF SPUTTERED Cu ATOMS R. V. Stuart and G. K. Wehner p 3-35 refs (See N64-12479 04-23)

4. ENERGY DISTRIBUTIONS OF Cu ATOMS SPUTTERED BY He, Ne, Ar, Xe, AND Hg p 36-46 (See N64-12480 04-23)

5. ENERGY DISTRIBUTIONS OF SPUTTERED ATOMS FOR VARIOUS POLYCRYSTALLINE TARGETS p 47-54 (See N64-12481 04-23)

N64-12477 General Mills, Inc., Minneapolis, Minn.
TIME OF FLIGHT MEASUREMENT OF VELOCITIES OF SPUTTERED ATOMS
R. V. Stuart and G. K. Wehner *In its* Sputtering Yields 15 Nov. 1963 Repr. from Trans. 9th Natl. Vacuum Symp. of the Am. Vacuum Soc., 1962 p 160-163 refs (See N64-12476 04-23)

A method is described whereby velocities of sputtered atoms are determined by pulsing a target and measuring the transit time of sputtered atoms. Velocity distributions of sputtered atoms for polycrystalline and single crystal copper are presented. Average velocities are found to be in the range 3 to 10 ev, in good agreement with previous measurements. In the case of single crystal targets, unexpectedly high velocities are observed in oblique ejection directions. Author

N64-12478 General Mills, Inc., Minneapolis, Minn.
TIME-OF-FLIGHT METHOD OF DETERMINING VELOCITIES OF SPUTTERED ATOMS
R. V. Stuart, K. Brower, and W. Mayer *In its* Sputtering Yields 15 Nov. 1963 Repr. from Trans. 9th Natl. Vacuum Symp. of the Am. Vacuum Soc., 1962 p 160-163 refs (See N64-12476 04-23)

A method is described whereby velocities of sputtered atoms are determined by pulsing a target and measuring the transit time of sputtered atoms. The method permits determination of the distribution of velocities of sputtered atoms. The target pulse generator and the problems involved in pulsing a target are discussed. The photon-counting system used for determining transit times is described, and a typical set of data is presented. Author

N64-12479 General Mills, Inc., Minneapolis, Minn.
ENERGY DISTRIBUTIONS OF SPUTTERED Cu ATOMS
R. V. Stuart and G. K. Wehner *In its* Sputtering Yields 15 Nov. 1963 Repr. from Trans. 9th Natl. Vacuum Symp. of the Am. Vacuum Soc., 1962 p 160-163 refs (See N64-12476 04-23)

Energy distributions have been obtained for atoms sputtered from Cu (100), (110), (111), and polycrystalline surfaces bombarded by 80- to 1200-ev Hg and noble gas ions. Energies of sputtered atoms are found to depend markedly on the angle of ejection. For a (110) surface bombarded by 1000-ev Kr ions, average energies of ejected atoms are 9.5 ev in the [110] direction (normal to the surface) and 14.2 ev in the [011] direction (60° to the surface normal). Ejection energies decrease for lighter ions in the order Kr^+, Ar^+, Ne^+ and He^+. For a (110) surface bombarded by 600 ev He ions, the average energy of atoms ejected in the [110] direction is 5.5 ev. Dependence on bombarding ion energy is very weak above 1000 ev where average energies of sputtered atoms are found to be in the range 5 to 15 ev. Author

N64-12480 General Mills, Inc., Minneapolis, Minn.
ENERGY DISTRIBUTIONS OF Cu ATOMS SPUTTERED BY He, Ne, Ar, Xe, AND Hg
In its Sputtering Yields 15 Nov. 1963 Repr. from Trans. 9th Natl. Vacuum Symp. of the Am. Vacuum Soc., 1962 p 160-163 refs (See N64-12476 04-23)

Energy distributions curves are presented. These curves are in many ways similar to those for Kr ion bombardment. As in the case of Kr, the most distinctive feature of each set of curves is the fact that the most probable energy (the energy at which the maximum occurs) is independent of bombarding ion energy except at the very lowest energies. The high energy tail increases with increased ion energy but in each case the energy distribution appears to be approaching an asymptotic limit characteristic of the bombarding ion and the angle of ejection. Results for lower energy He ion bombardment (below 450 ev) could not be obtained because the high floating potential caused a high background counting rate which could be overcome only at high bombarding ion energies. Author

N64-12481 General Mills, Inc., Minneapolis, Minn.
ENERGY DISTRIBUTIONS OF SPUTTERED ATOMS FOR VARIOUS POLYCRYSTALLINE TARGETS
In its Sputtering Yields 15 Nov. 1963 p 47-54 Based on papers presented to the 23rd Ann. Conf. on Phys. Electron., MIT, and 6th Intern. Conf. on Ionization Phenomena in Gases, Paris (See N64-12476 04-23)

Results on the energy distributions of sputtered atoms from various polycrystalline targets are still too limited to have established a discernible distribution pattern; however, it is evident that no simple relationship to the mass of the target atom exists. The energy distribution of sputtered atoms for Au targets bombarded by Kr ions appears to give support to the observation that the energy distributions of sputtered atoms seem to approach an asymptotic limit at about 1000-ev bombarding ion energy. I.v.L.

N64-12496 Joint Publications Research Service, Washington, D.C.
ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF THE HYDRATED ELECTRON IN IRRADIATED FROZEN ALKALINE SOLUTIONS
B. G. Yershov, A. K. Pikayev, P. Ya. Glazunov, and V. I. Spitsyn *In its* Transl. from Dokl. Akad. Nauk SSSR [Moscow], v. 149, no. 2, 1963 18 Jul. 1963 p 12-18 refs (See N64-12493 04-01) OTS: $1.00

An analysis of the EPR spectrum of irradiated frozen 10 m KOH solutions in heavy water shows the superposition of the triplet belonging to the D atom, the singlet of the ion-radical $O^-{\cdot}nH_2O$, and the narrow line of e^-_{aq}(hydrated electron). After the sample was exposed for 10 minutes at −150° C, the triplet of the D atom disappears, and, just as in the case of H_2O, the two singlets, belonging to $O^-{\cdot}nD_2O$ and e^-_{aq}, remain. In the case of D_2O, the width of the line assigned to $O^-{\cdot}nD_2O$ is the same as for H_2O. This confirms the authors' hypothesis

that the unpaired electron in this ion-radical is localized in the oxygen atom. At the same time, the line belonging to e^-_{aq} is constricted ($\Delta H = 7$ oersteds). The latter circumstance is apparently due to the interaction of the electron with the spins of the surrounding nuclei and the difference in the values of the magnetic moments of the H and D nuclei. As the KOH concentration increases, the radical yield increases in ice irradiated at −196° C. This can be explained by the stabilization of e^-_{aq} and the conversion of OH to $O^-{\cdot}nH_2O$, and the resultant decrease in the probability of recombination of the radical products during irradiation. I.v.L.

N64-12532* Oak Ridge National Lab., Tenn.
CALCULATIONS OF THE THREE-DIMENSIONAL DEVELOPMENT OF HIGH ENERGY ELECTRON-PHOTON CASCADE SHOWERS
C. D. Zerby and H. S. Moran *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 3–7 refs (See N64-12531 04-01) OTS: $2.75

Results from the IBM-7090 Monte Carlo calculations of electron-photon cascades for particle energies up to 50 Gev are compared with experiments. Fair agreement is shown with preliminary results from a Stanford experiment in which the energy deposited in copper by a shower initiated by 950-Mev electrons was determined. Reasonably good agreement is also shown with results of an experiment in which electron beams of 100, 200, and 380 Mev were directed into a bubble chamber and the number of charged particles (E> 1 Mev) that passed through a lead slab in the chamber was determined. Author

N64-12533* Oak Ridge National Lab., Tenn.
STUDIES OF THE CREATICN OF POSITRONS IN TARGETS BY A 1-Gev ELECTRON BEAM
C. D. Zerby and H. S. Moran *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 7–9 refs (See N64-12531 04-01) OTS: $2.75

An electron-photon cascade calculation was used to calculate the generation of positrons in 3-radiation-length-thick targets bombarded by a narrow 1-Gev electron beam. The materials considered were lead, tin, copper, and aluminum, with lead yielding the largest conversion of incident electrons into positrons. For the lead target the ratio of electrons to positrons is always greater than unity, and their energy distributions appear to be similar in shape. Radial distributions of the positrons and electrons in the lead were also calculated. Author

N64-12534* Oak Ridge National Lab., Tenn.
CALCULATION OF ENERGY DEPOSITED IN WATER, ALUMINUM, AND COPPER BY A 20-Gev ELECTRON BEAM
C. D. Zerby and H. S. Moran *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 9–11 (See N64-12531 04-01) OTS: $2.75

Calculations of the energy deposited by a narrow 20-Gev electron beam in water, aluminum, and copper (materials being considered for the beam stopper of the Stanford linear accelerator) have been performed. In the case of water a rough calculation using the energy deposition data indicates that it would take approximately 11 sec to completely vaporize the water if it were not circulated. The dissociation of hydrogen and oxygen would also be significant. Author

N64-12535* Oak Ridge National Lab., Tenn
CALCULATION OF ENERGY DEPOSITED IN SHIELDED SOLAR CELLS BY HIGH-ENERGY ELECTRONS
C. D. Zerby and H. S. Moran *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 12–13 refs (See N64-12531 04-01) OTS: $2.75

Calculations of the energy deposited by 3.0- and 6.0-Mev electrons incident on a 0.04064-cm-thick solar cell having an aluminum shield of various thicknesses have been made. Discrepancies between the calculated results for the 3.0-Mev case and experimental results obtained for a 3.51-Mev incident energy are probably due to inaccuracies in the calculation at low energies and to the slight difference in the incident energies. The discrepancies are small enough, however, for the calculations to be useful in extending the experimental data. Author

N64-12536* Oak Ridge National Lab., Tenn.
A COLLIMATOR STUDY FOR A 20-Gev ELECTRON BEAM
C. D. Zerby and H. S. Moran *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 13 refs (See N64-12531 04-01) OTS: $2.75

A summary is presented of an investigation of the behavior of incident electrons and the resulting secondary radiations in collimators, or constrictions, proposed for installation along the tube of a linear electron accelerator. P.V.E.

N64-12537* Oak Ridge National Lab., Tenn.
PRELIMINARY RESULTS FROM NUCLEAR EMULSIONS EMBEDDED IN A STEEL SHIELD EXPOSED TO A NARROW 9-Gev/c PROTON BEAM
R. L. Childers (Tenn. U.) *In its* Neutron Phys. Div. Ann. Progr. Rept. 18 Dec. 1963 p 14–22 refs (See N64-12531 04-01) OTS: $2.75

Preliminary measurements have been made on a set of nuclear emulsions exposed at various positions in a steel shield on which a narrow 9-Gev/c proton beam impinged. The emulsions were placed both along the axis of the nuclear cascade and at various distances off the axis. The results of the measurements on the track intensity indicate an attenuation length of 133 ± 8 g/cm^2 along the shower axis. The lateral distributions of shower-track intensity and the star density along the beam axis are presented. Author

N64-12538* Oak Ridge National Lab., Tenn.
SPACE VEHICLES SHIELDING STUDIES: THE ATTENUATION OF SOLAR FLARES BY ALUMINUM SHIELDS
R. G. Alsmiller, Jr. and J. E. Murphy *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 25–26 refs (See N64-12531 04-01) OTS: $2.75

Nucleon-meson cascade calculations have been carried out, with the "straight ahead" approximation, for several solar-flare proton spectra incident on a shield. The shielding material has approximately the properties of aluminum. Both spherical-shell and slab geometries are considered. Author

N64-12539* Oak Ridge National Lab., Tenn.
INTRANUCLEAR CASCADE CALCULATIONS FOR INCIDENT PARTICLE ENERGIES FROM 25 TO 350 Mev AND FROM 25 Mev TO 2 Gev
H. W. Bertini *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 27–30 refs (See N64-12531 04-01) OTS: $2.75

The code to calculate the reactions of 25- to 350-Mev particles with complex nuclei has been put into production, and data will soon be available for distribution through the Radiation Shielding Information Center (RSIC), along with the cascade code itself and the three codes used to analyze the results of the calculation. The code to calculate the reactions of particles with energies up to 2 Gev with complex nuclei is now in

the debugging stage and should be available for calculating preliminary data within the next few months; however, considerable modification will be required before the final version of the code is completed. The type of information available from the calculations up to 350 Mev is described briefly, and some of the modifications which will be required for the higher-energy calculations are discussed. Author

N64-12540* Oak Ridge National Lab., Tenn.
PARAMETRIC STUDY OF CALCULATED CASCADE AND EVAPORATION REACTIONS FOR 25- TO 400-Mev NUCLEONS INCIDENT ON COMPLEX NUCLEI
H. W. Bertini *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 31–53 refs (See N64-12531 04-01) OTS: $2.75

A parametric study has been made of typical cases from cascade calculations. The study covers 50-, 200-, and 400-Mev protons incident on C^{12}, Al^{27}, Cu^{65}, and Pb^{207} and neutrons incident on Al^{27} at the same energies. The type of information covered includes excitation energy distributions of the residual nucleus resulting from cascade reactions, the average number of emitted cascade nucleons per inelastic collision, normalized cascade and evaporation particle spectra, and angular distributions of emitted cascade nucleons. In addition, comparisons of calculated and experimental radiochemical cross sections are made. Author

N64-12541* Oak Ridge National Lab., Tenn.
LITERATURE SURVEY OF NONELASTIC NUCLEON AND P ION REACTIONS WITH COMPLEX NUCLEI
H. W. Bertini *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 54–56 refs (See N64-12531 04-01) OTS: $2.75

In order to locate experimental data with which the results from intranuclear cascade calculations can be compared and also to provide the particle-particle cross-section data required by the calculations, a continuing survey of the literature is being made. Some of the results of the search for the nonelastic reactions have been collected in a single publication, and a sample page from that report is represented. Author

N64-12542* Oak Ridge National Lab., Tenn.
CALCULATION OF DOSE IN TISSUE DUE TO NUCLEONS BELOW 400 Mev
W. E. Kinney and C. D. Zerby *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 56–60 refs (See N64-12531 04-01) OTS: $2.75

Calculations of the average whole-body dose in an infinite slab of tissue 30 cm thick due to 100-, 200-, 300-, and 400-Mev nucleons both normally incident and isotropically incident on the slab have been performed. For all cases of incident protons the primary proton beam is the main contributor to the dose, although for an incident energy of 400 Mev the rem dose due to heavy secondary particles amounts to as much as 69% of the normally incident primary dose, and the secondary proton dose amounts to 43% of the primary dose. At 100 Mev the rem dose due to secondaries is only one-sixth the normally incident primary rem dose. At 400 Mev the dose from secondary radiation at a 400-Mev incident energy is about the same for both incident neutrons and incident protons. Flux-to-dose conversion factors are presented for all cases considered. Author

N64-12543* Oak Ridge National Lab., Tenn
A PROPOSED NOMENCLATURE SCHEME FOR EXPERIMENTAL HIGH-ENERGY NUCLEAR CROSS SECTIONS
C. D. Zerby and H. Goldstein (Columbia U.) *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 63-66 refs (See N64-12531 04-01) OTS: $2.75

A set of rules previously formulated for low-energy nuclear cross-section terminology and associated notation has been modified and extended to include high-energy radiations. The new set of rules aids in interpreting the current set of experiments with beams of 160-Mev protons. Author

N64-12544* Oak Ridge National Lab., Tenn.
SPECTRA OF GAMMA RAYS PRODUCED BY THE INTERACTION OF APPROXIMATELY 160-Mev PROTONS WITH Be, C, O, Al, Co, AND Bi A Summary
W. Zobel, F. C. Maienschein, and R. J. Scroggs *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 66–72 refs (See N64-12531 04-01) OTS: $2.75
(ORNL-3506, Summary)

Photon spectra due to interactions of 160-Mev protons from the Harvard University synchrocyclotron with Be, C, O, Al, Co, and Bi were measured with two multiple-crystal scintillation spectrometers. Time-of-flight requirements aided in the rejection of neutron-induced backgrounds. Thin-target pulse-height spectra are presented, together with one unscrambled spectrum. A limited amount of thick-target data was also obtained. Cross sections are given for the production of gamma rays at specified energies. Author

N64-12545* Oak Ridge National Lab., Tenn.
DIFFERENTIAL SECONDARY-NUCLEON CROSS SECTIONS BY FLIGHT-TIME SPECTROSCOPY FOR REACTIONS OF 160-Mev PROTONS WITH NUCLEI
R. W. Peelle, T. A. Love, N. W. Hill, R. L. Cowperthwaite, and R. T. Santoro *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 73–84 refs (See N64-12531 04-01) OTS: $2.75

Flight-time spectral data have been obtained at several angles for secondary neutrons and protons resulting from reactions of 160-Mev protons on targets of Bi, Pb, Co, Cu, Al, C, Be, D_2O and H_2O. The status of the data analysis is described, and representative low-resolution proton spectra are shown. Details are given of the method of handling the low-intensity proton beam so that events are recorded only when incident protons are separated sufficiently in time to avoid ambiguity. Observed cross sections for the production of secondary protons from cobalt are shown for five angles, illustrating the softening of the spectrum at large scattering angles. Author

N64-12546* Oak Ridge National Lab., Tenn.
DEPTH-DOSE DISTRIBUTION PRODUCED IN A SPHERICAL WATER-FILLED PHANTOM BY INTERACTIONS OF A 160-Mev PROTON BEAM An Abstract
F. C. Maienschein and T. V. Blosser *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 84 (See N64-12531 04-01) OTS: $2.75
(ORNL-3457)

Measurements have been made of the total energy deposited at various points within a 42-cm-diam. spherical water-filled Lucite phantom by the secondary particles resulting from 160-Mev proton reactions with various targets. The proton beam energy determined from a part of these results, 160 to 162 Mev, is in good agreement with published values. The energy deposited by secondary particles was found to increase with Z, as was expected. The curves of depth dose due to secondary particles have a steeply negative slope over the region near the surface of the phantom and a more gentle slope at greater depths. The magnitude of the

dose in the region of the initial slope, which is presumably due to secondary protons, decreases with increasing target thickness. The magnitude of the dose at greater depths increases with increasing target thickness. Author

N64-12547* Oak Ridge National Lab., Tenn.
ABSORBED DOSE IN A WATER-FILLED SPHERICAL PHANTOM DUE TO 14-Mev AND Po-Be NEUTRONS
T. V. Blosser and R. M. Freestone, Jr. *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 85–88 refs (See N64-12531 04-01) OTS: $2.75

A small ethylene-filled ionization chamber was used to measure the depth-dose distribution within a water-filled 42-cm-diam. spherical Lucite phantom resulting from a beam of 14.1-Mev neutrons and from the neutron spectrum of a Po-Be source. The results are compared with earlier depth-dose curves resulting from exposure of the phantom to the nuclear secondaries from aluminum targets in a 160-Mev proton beam. Author

N64-12548* Oak Ridge National Lab., Tenn
NEUTRON AND PROTON SPECTRA FROM TARGETS BOMBARDED BY 160-Mev PROTONS
J. W. Wachter, W. A. Gibson, W. R. Burrus, and C. F. Johnson (Gen. Dynamics Corp.) *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 89–93 refs (See N64-12531 04-01) OTS: $2.75

The spectra of neutrons and protons resulting from interactions of 160-Mev protons from the Harvard University synchrocyclotron with targets of H_2O, D_2O, Be, C, Al, Co, Cu, and Bi have been measured with proton-recoil spectrometers. The method used to calculate energy spectra from the pulse-height distributions obtained from the spectrometers is described, and typical spectra obtained for beryllium, aluminum, and bismuth are presented. The results for the energy range 50 to 160 Mev include neutron spectra at 10° and 45° to the incident beam for targets thicker than the incident proton range, proton spectra at 10° for the same targets, and proton spectra at 60° for thin targets that absorbed about 2.5 Mev from the primary beam. Proton spectra at 135° for the energy range 10 to 50 Mev are also shown. Author

N64-12549* Oak Ridge National Lab., Tenn.
SCINTILLATION EFFICIENCY OF NaI(Tl) FOR CHARGED PARTICLES
W. A. Gibson, W. R. Burrus, J. W. Wachter, and C. F. Johnson (Gen. Dynamics Corp.) *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 93–94 refs (See N64-12531 04-01) OTS: $2.75

A method is described for calculating the efficiency (dI/dE) of a scintillator from a knowledge of the pulse-height distributions produced by charged particles as they penetrate the scintillator. A curve of dI/dE vs dE/dx is presented for 50- to 160-Mev protons incident on a 1.464-g/cm^2 NaI(Tl) crystal. Author

N64-12550* Oak Ridge National Lab., Tenn.
SPACE, TIME, AND ENERGY DISTRIBUTIONS OF THE PROTON BEAM FROM THE HARVARD UNIVERSITY SYNCHROCYCLOTRON
R. T. Santoro *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 95–100 refs (See N64-12531 04-01) OTS: $2.75

Measurements of the spatial distribution by X-ray film techniques and by profile telescope methods indicate that there was a normal distribution of protons across the beam, with 86% of the protons included in two standard deviations and a full-width at half-maximum at 6.6 mm. The beam cross section was circular. The cyclotron duty factor was found to be about 4%. From range-energy measurements, for which copper absorbers were used, the proton energy was found to be 160.9 Mev; independent time-of-flight measurements resulted in a value for the energy of 154.4 Mev. Author

N64-12551* Oak Ridge National Lab., Tenn.
MEASUREMENTS OF THE INTENSITY OF THE PROTON BEAM OF THE HARVARD UNIVERSITY SYNCHROCYCLOTRON FOR ENERGY-SPECTRAL MEASUREMENTS OF NUCLEAR SECONDARIES
R. T. Santoro and R. W. Peelle *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 100–104 refs (See N64-12531 04-01) OTS: $2.75

Two thin helium-filled parallel-plate ionization chambers were used to monitor the intensity of the 160-Mev beam of the Harvard University synchrocyclotron during various spectral measurements. The chambers were calibrated by two independent methods—by comparison with measurements of the absolute beam intensity made with a Faraday cup and by comparison with the results of direct counting of the protons in the beam by fast counting techniques. The two determinations were in agreement within $< 5\%$. A drift in the calibration of the chambers during the spectral runs was confirmed by measurements with an Sr^{90} source, and is ascribed to a gradual contamination of the helium filling gas by air leakage. Author

N64-12552* Oak Ridge National Lab., Tenn.
PREPARATIONS AT ORIC FOR CONTINUED MEASUREMENTS OF ENERGY SPECTRA OF NUCLEAR SECONDARIES
R. T. Santoro *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 104–105 refs (See N64-12531 04-01) OTS: $2.75

The experimental space shielding program will be continued at the Oak Ridge isochronous cyclotron (ORIC), where an ~75-Mev proton beam will be available. Existing experimental apparatus is being modified for use with this accelerator, and the gamma-ray spectrometer to be used in the first measurements of secondary spectra has already been installed at ORIC. A spectrometer positioning device and a special evacuated target holder are being designed. Author

N64-12553* Oak Ridge National Lab., Tenn.
PROTON-RECOIL SPECTROMETERS FOR MEASURING NEUTRON AND PROTON ENERGY SPECTRA FROM 10 TO 450 Mev
W. A. Gibson, W. R. Burrus, J. W. Wachter, and C. F. Johnson (Gen. Dynamics Corp.) *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 109–111 refs (See N64-12531 04-01) OTS: $2.75

Two proton-recoil spectrometers for use in the neutron and proton energy range 10 to 450 Mev have been tested. The difficulties encountered with the 10- to 50-Mev spectrometer are discussed, and it is concluded that the background due to interaction of high-energy neutrons with the sensitive portions of the counters and with the carbon of the radiator places severe restrictions on the usefulness of this spectrometer. The 50- to 450-Mev spectrometer performed satisfactorily when exposed to secondary neutrons and protons from a target bombarded by 160-Mev protons; however, a large background was encountered in measuring the spectra of secondaries from targets bombarded by 450-Mev protons. A device to eliminate this background is being constructed. Author

N64-12554* Oak Ridge National Lab., Tenn.
DETERMINATION OF COINCIDENCE-CIRCUIT EFFICIENCY BY VARYING THE INPUT SIGNAL DELAY

R. W. Peelle *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 112–115 refs (See N64-12531 04-01) OTS: $2.75

The efficiency of a twofold coincidence circuit for counting simultaneous events is considered in terms of the jitter in the timing of the pulses at its input relative to the detected event. Two methods are suggested for analysis of empirical delayed coincidence curves for inferring coincidence efficiency. Graphs are given to relate the breadth of the jitter distribution and the coincidence efficiency to the derivative of the observed delayed coincidence curve near efficiency one-half. Author

N64-12555* Oak Ridge National Lab., Tenn.
CALCULATION OF THE EFFICIENCY AND RESOLUTION OF A PROTON RECOIL SPECTROMETER BY MONTE CARLO METHODS
W. E. Kinney and J. W. Wachter *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 115–119 refs (See N64-12531 04-01) OTS: $2.75

A computer code employing Monte Carlo methods has been constructed to calculate the absolute efficiency and energy resolution of a proton-recoil neutron spectrometer from a knowledge of the n,p scattering cross section, the dimensions of the proton radiator, and the experimental geometry. The computation allows radiators of arbitrary thickness and a variety of source distributions and takes account of energy losses in materials intervening between the radiator and the dE/dx counter. The results given by the code have been checked against infinitely thin radiator calculations made by conventional numerical integration techniques, and excellent agreement exists. Author

N64-12556* Oak Ridge National Lab., Tenn.
SOME RECENT APPLICATIONS OF THE SLOP CODE FOR UNFOLDING INSTRUMENT RESPONSE
W. R. Burris *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 120–214 refs (See N64-12531 04-01) OTS: $2.75

The SLOP code for unfolding a set of instrument readings, each typically a pulse-height distribution stored by a multichannel analyzer, to obtain a smoothed approximation to the desired gamma-ray or neutron spectrum was described previously, and some early results of the application of the code to experimental data have been published. This paper describes the results obtained by using the code to unfold neutron spectra measured with liquid and plastic scintillators and gamma-ray spectra obtained with an anticoincidence-type multicrystal NaI(Tl) spectrometer. All spectra are shown as confidence bands corresponding to a confidence level of 68%. Author

N64-12557* Oak Ridge National Lab., Tenn.
A CALCULATION OF THE PULSE-HEIGHT RESPONSE OF SCINTILLATORS TO HIGH-ENERGY ELECTRONS, POSITRONS, OR PHOTONS
C. D. Zerby and H. S. Moran *In its* Neutron Div. Ann. Progr. Rept. 18 Dec. 1963 p 124–126 refs (See N64-12531 04-01) OTS: $2.75

The electron–proton cascade calculation was modified for use in calculating the pulse-height response of scintillation counters to high-energy radiations. The computer program considers a cylindrical detector of almost arbitrary composition and a source of positrons, electrons, or photons having energies up to 50 Gev. The source can be an isotropic point on the axis of the detector or a monodirectional source uniformly distributed over a circle which is concentric with the cylinder. Although the accuracy of the calculation has not yet been confirmed, the shapes of calculated and experimental curves for a plastic scintillator exposed to 129.4-Mev photons have a striking similarity. Author

N64-12575 Electrotechnical Lab., Tokyo (Japan)
GENERAL REVIEW OF STUDIES ON LOUDNESS
Ryunen Teranishi Jan. 1963 64 p refs In JAPANESE; Summary and contents in ENGLISH
(*Its* Circular 153)

In this paper, the scaling techniques and the specifications for "phon" and "sone," and the calculation of loudness are reviewed historically. The general equation for loudness magnitude is discussed. The paper is divided into the following sections: requirements for quantitizing loudness, terminology, general discussion of scales and units, loudness scales, history of loudness expressions and specifications, experiments of loudness level, experiments of loudness scales, calculation of loudness, loudness and time duration, criteria for rating noise, present specifications, and future problems. Author

N64-12579 Defense Atomic Support Agency, Washington, ton, D.C.
ELECTROMAGNETIC PULSE BIBLIOGRAPHY
Charles A. Blank, comp. 17 Jan. 1963 16 p refs
(DASA-618; AD-296777)

A bibliography is presented of the literature dealing with the electromagnetic pulse arising from nuclear detonation. R.T.K.

N64-12594 General Dynamics Corp., Groton, Conn. Electric Boat Div.
SOUND RADIATION FROM A CYLINDRICAL SHELL Final Report
C. P. Tsokos and E. L. North Dec. 1962 121 p refs
(Contract Nonr-3280(00))
(U413-62-173; AD-422496)

This report describes the acoustical and dynamic effects resulting from an increase in the number of stiffeners in a cylindrical shell. These effects were determined experimentally using a 1/7-scale model approximating the engine room section of a nuclear submarine hull. Tests were conducted in both air and water environment. A new approach is utilized to determine the radiated acoustic power from near-field measurements. Author

N64-12596 Aerospace Information Div., Library of Congress, Washington, D.C.
NONLINEAR FIELD THEORIES (ANNOTATED BIBLIOGRAPHY) [Period Covered Jan. 1958–Feb. 1963]
21 Oct. 1963 40 p refs
(AID-B-63-115; AD-422890) OTS: $3.60 ph, $1.40 mf

A preliminary survey of Soviet-Bloc materials on nonlinear field theories (elementary particles) from the period January 1958 to February 1963 is presented. P.V.E.

N64-12618 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NOMOGRAMS FOR THE CALCULATION OF PERMISSIBLE DOSAGES OF FAST NEUTRONS FROM Po+Be SOURCES
Jan A. Czubek and Andrzej Zuber 9 Oct. 1963 7 p refs
Transl. into ENGLISH of an article from Nukleonika (Warsaw), v. 7, no. 6, 1962 p 419–423
(FTD-TT-63-862/1+2; AD-423837)

Nomograms, which may be useful in evaluating the permissible dosages obtained during work with Po+Be sources, are presented. The calculations were based on the permissible stream of fast neutrons from Po+Be sources as being that

of 10 n/m^2, during a 40-hour work week. The nomograms were calculated for Soviet sources with a capacity of 1.8 x 10^6 n/sec curie. I.v.L.

N64-12626 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
VAPOR PRESSURE AND EVAPORATION OF SUBSTANCES IN MOVABLE AIR
V. G. Matsak 8 Nov. 1963 15 p Transl. into ENGLISH from Gigiena i Sanit. (Moscow), p 35–41
(FTD-TT-63-1044/1+2; AD-425608)

A report was given to provide hygienists and engineers, working in the field of sanitation technology, with concrete, well-founded data on vapor pressure and rate of evaporation in movable air of various inorganic and organic substances. Special attention was given to substances, most frequently used in technology, and to toxic substances as well. A nomogram was worked out for determination of the pressure of saturated vapor, along with a method of calculating the rate of evaporation of various chemical substances in moving air. C.L.W.

N64-12641 Naval Radiological Defense Lab., San Francisco, Calif.
GEOMETRY AND BARRIER ATTENUATION GENERATED BY A VERTICAL SLAB EXPOSED TO A PLANE Co^{60} SOURCE
G. E. Plummer and W. G. Miller 27 Sep. 1963 47 p refs
(USNRDL-TR-677; AD-424495)

A solution to the problem of how one may determine the dose received by a detector that has a vertical barrier interposed between it and a horizontal infinite radiation field has been attempted. Steel barriers of effective mass thickness 0 to 73 lb/ft^2 were employed. The detector was collimated so that regardless of its distance from the barrier it always saw a constant circular area on the barrier. The infinite radiation field was simulated by a traveling Co^{60} source that was pumped through an array of plastic tubing that covered a 100-ft semicircular area. An extrapolation to the infinite field case was attempted. The final results are expressed as ratios of dose received by a collimated, shielded detector relative to the free-in-air dose received by an unprotected detector 3 ft above the plane. The experimental points are compared to a family of theoretical curves. Author

N64-12644 Naval Radiological Defense Lab., San Francisco, Calif.
THE EFFECT OF SOURCE DISTANCE ON BUILDUP FACTOR FOR GAMMA RAYS PENETRATING INTO A COMPARTMENTED STRUCTURE
S. Tomoeda, A. L. Frank, and M. B. Hastings 8 Oct. 1963 40 p refs
(USNRDL-TR-681; AD-424880)

In order to correlate some basic measurements of radiation attenuation made on an aircraft carrier to other situations and geometries, experiments were carried out to study the effects of source distance on the dose distribution inside a model-sized compartmented structure intended to simulate the carrier. Data are presented in the form of buildup factors (B_r) as a function of source-to-detector distance for two configurations of the compartmented structure. Buildup factors are also presented as a function of the slant path through the interposing steel plates for the case where the source is considered far from the structure. In every case, the buildup factor for the compartmented structure was found to be consistently and significantly lower than the single slab data. The greatest differences in buildup (B_r-1) amounted to 30 percent. Among the several effects that contribute to the buildup, the slant path of the primary radiation and the effects due to the geometry of the detector and slab appear most important. Author

N64-12650 Bendix Corp., Baltimore, Md.
INTERFERENCE APPLIED RESEARCH DATA COLLECTION AND ANALYSIS MAGNETIC FIELD MEASUREMENT TECHNIQUES Final Report
James L. Mc Kain Griffiss AFB, N.Y., Electromagnetic Vulnerability Lab., Oct. 1963 149 p refs
(Contract AF 30(602)-2733)
(RADC-TDR-63-75; AD-423101)

This report is a summary of the experimentally verified techniques employed in pickup devices and types of instrumentation equipment available for the measurement of magnetic fields in the frequency range of 1 cps to 10 gc. Consideration is given to the measurement of the magnetic component of an electromagnetic wave, both in the near and far fields. The effect of the measuring device on the unknown field is discussed. Calibration of magnetic component transducers by the generation of standard fields is presented. A table of instruments currently available for magnetic and/or electromagnetic measurements pertinent to the RFI field of interest is included. A list of carefully screened references represents a considerable portion of the study. Author

N64-12651 Michigan U., Ann Arbor Electron Physics Lab.
INVESTIGATION OF LARGE-SIGNAL TRAVELING-WAVE TUBES
G. T. Konrad et al Griffiss AFB, N.Y., Techniques Lab., Oct. 1963 48 p refs
(Contract AF 30(602)-2834)
(RADC-TDR-63-398; AD-422923)

Further work on the digital computer program for solution of nonlinear phenomena in traveling-wave devices and klystrons is described. A different formulation is presented for eliminating certain difficulties in the solution of the Boltzmann–Vlasov equation, used in the analysis of large-signal phenomena in multistream microwave devices. Performance data of the step-tapered traveling-wave tube are presented. Comparison is made with a uniform tube and other phase velocity tapered tubes. Representative results for several electron guns analyzed by digital computer programs are shown in the form of trajectory plots and current density curves. The results obtained from a low-noise, high-power amplifying chain are summarized. Author

N64-12671 Western Reserve U., Cleveland, Ohio
SYSTEMATIC CALCULATION OF VARIOUS PROPERTIES OF SPHERICAL NUCLEI Final Report
Leonard S. Kisslinger 25 Sep. 1963 4 p refs
(Grant DA-ORD-31-124-61-G81)
(AROD-2890-4; AD-421714)

Topics discussed include: (1) the systematic calculation of various properties of spherical nuclei, (2) the systematic calculation of the magnetic dipole moments of odd-mass nuclei with $28 \leq Z \leq 82$, (3) the effect of spin-dependent forces on the quadrupole vibrational states in the nuclei, (4) the plane wave Born approximation of the excitation of the collective states in terms of a microscopic model for these states, and (5) the beta decay of $Sb^{124} \rightarrow Te^{124}$. R.T.K.

N64-12682 Colorado U., Boulder
ELECTRON TRANSPORT THEORY AT LOW TEMPERATURES Final Report

Edward J. Davies, DeLee Minner, and S. C. Miller Oct. 1963 43 p
(Grant DA-ORD-31-124-60-G50)
(AROD-2870-5; AD-423656)

This report covers four different problems: (1) The ground states of donor impurities in germanium for high magnetic fields and their effect on the electron density in the conduction band are discussed. It was found that for the impurity concentrations, temperatures, and magnetic field strengths considered, the electron density in the conduction band is essentially constant. (2) The conductivity tensor for n-germanium in magnetic fields for acoustic scattering is found. The calculations are based on a density matrix treatment where an expansion in powers of the scattering potential is used. (3) This section is essentially a progress report on hot electrons in high magnetic fields in semiconductors. The formalism here is based on expansion of the density matrix in powers of the scattering potential. However, it is not limited to linear terms in the electric field. (4) A possible explanation of lack of freezeout of the electrons onto the donor impurities due to a magnetic field in indium antimonide is discussed. It is based on a hydrogen molecule model for the impurities. Author

N64-12683 Radio Corp. of America, Burlington, Mass.
LINEAR SHAPED CHARGE SEPARATION TESTS Final Report
S. J. Engel, J. Newell, and R. R. Batchelder 21 Oct. 1963 331 p
(Contract AF 04(695)-273)
(SSD-TDR-63-279; AD-423008)

This final report presents the study and test results of a flexible linear-shaped charge (FLSC) system designed for space vehicle stage separation. Three full-size separation tests using the P706 interstage and FLSC system are described. Each system was subjected to a different environment prior to the separation tests. Also included are shock spectra data calculations obtained using an IBM 7090 program operating on the raw shock data measured. The successful separations demonstrate that the system is functionally acceptable. The magnitude of the shock response decreases with distance from the separation plane. Correlation between test results is good. Author

N64-12694* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PHENOMENOLOGICAL MODEL OF THERMOPHOTOTROPISM
John B. Schutt Washington, NASA Jan. 1964 19 p refs (NASA TR R-184) OTS: $0.50

An equation is developed which describes the phenomenology of thermophototropism. The equation could have application to thermal analysis and, hence, be used in a feasibility study on thermophototropes for temperature control in the space environment. A literature survey is included in the appendix. Author

N64-12703 Barcelona U. (Spain)
NEW LAW AND EFFECTS RELATING THE ULTRAVIOLET SPECTRUM OF SUBSTITUTED BENZENES AND THE MIGRATION (SPECTROSCOPIC) MOMENT
Manuel Ballester and Juan Riera 28 Jan. 1963 50 p refs
(Contract AF 61(052)-141)
(ARL 63-220; AD-424474)

It is shown that the integrated absorptivity of the $^1A_{1g} \rightarrow {}^1B_{2u}$ transition benzene band is a linear function of the intensity of the resultant migration (spectroscopic) moment. This is attributed to an ever-present "saturation effect". Other effects, such as the "vibrational perturbation" and the "positive and negative ortho effects", are also studied. One hundred and six ultraviolet spectra are studied. Author

N64-12774 Joint Publications Research Service, Washington, D.C.
PRESENTATION OF RESULTS OF INVESTIGATIONS OF THE STRUCTURAL DEFECTS OF GERMANIUM
V. N. Maslov, L. V. Nabotova, V. V. Nalimov, I. N. Nyuberg, A. V. Ovodova et al *In its* Structural Defects of Germanium and High-Temp. Lab. 24 Dec. 1963 p 1-10 refs (See N64-12773 04-01)

Results of these investigations indicate that psychophysiological methods of ranking templets directly according to the visual form created by the etching depressions possess substantial advantages over methods based on computations of the number of dislocations. One main advantage is that fewer parameters need be considered. I.v.L.

N64-12817 Princeton U., N.J. Frick Chemical Lab.
VISCOELASTIC PROPERTIES OF STYRENE – ACENAPHTHYLENE COPOLYMERS IN THE TRANSITION REGION
R. J. Schaffhauser, M. C. Shen, and A. V. Tobolsky Nov. 1963 21 p refs
(Contract Nonr-1858(07))
(ONR-TR-RLT-66; AD-425079)

A series of styrene-acenaphthylene copolymers was prepared by thermal polymerization. Homogeneous samples were obtained except for those compositions where the initial concentration of styrene monomer was 40 to 60 mole percent. Master curves and characteristic viscoelastic parameters were obtained for the homogeneous copolymers. The plot of T_g versus copolymer composition yielded a linear relationship. Author

N64-12823 Emmanuel Coll., Boston, Mass. Research Language Center
LINE EMISSION AND ABSORPTION OF CHROMIUM PHOSPHORS, PART I [DIE LINIENHAFTE EMISSION UND ABSORPTION DER CHROMPHOSPHORE. I]
Otto Deutschbein Bedford, Mass., AFCRL May 1963 27 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 14, no. 5, 1932 p 712-228
(Contract AF 19(604)-8505)
(E-T-G-63-17; AD-412981)

The activity of chromium in its phosphors is examined under various conditions. Discussion includes the preparation and general luminescent properties of the samples fired, investigation of light and cathode-ray excitation, and the spectrographs, plates, and developer used in the analysis. Emission results are presented in tabular form. J.E.T.

N64-12824 Emmanuel Coll., Boston, Mass. Research Language Center
LINE EMISSION AND ABSORPTION OF CHROMIUM PHOSPHORS, PART II [DIE LINENHAFTE EMISSION UND ABSORPTION DER CHROMPHOSPHORE. II]
Otto Deutschbein Bedford, Mass., AFCRL May 1963 37 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 14, no. 5, 1932 p 729-754
(Contract AF 19(604)-8505)
(E-T-G-63-18; AD-415374)

An attempt was made to intercalate chromium which was capable of luminescing into the greatest possible number of base materials. Cr_2O_3, or larger, chromium molecules, if isomorphically intercalated, were the only materials successfully incorporated into base materials as luminescents. In addition, the emission spectra of luminescent substances were recorded by light and cathode-ray excitation at 20° C and −195° C. It was also found that Mg_2TiO_4, which is isomorphic to spinel, is luminescent with Cr. It has a spectrum similar to that of other spinels. J.E.T.

N64-12831 New York U., N.Y.
MEASUREMENT OF THE EFFECTIVE ELECTRIC POLARIZABILITIES OF $^3P_2$ METASTABLE ARGON IN SELECTED MAGNETIC SUBSTANCES Technical Report No. 7
Edward J. Robinson and Benjamin Bederson [1963] 37 p refs Submitted for Publication
(Contract Nonr-285(15); Grant DA-ARO-(D)-31-124-G269)
(AD-424934)

The atomic beam E-H gradient balance method has been employed to measure the z-component of the electric polarizability tensors, $\alpha_z(m_J)$, of the $m_J = +2$ and $m_J = +1$ magnetic substates of $^3P_2$ metastable argon. The measurements were normalized to the polarizability of $^3S_1$ metastable helium, which is calculable to within an accuracy of 1%. Author

N64-12840 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAGNETIC PROPERTIES OF METALS AT LOW TEMPERATURES
B. I. Verkin and I. F. Mikhaylov 30 Sep. 1963 12 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 25, no. 4(10), 1953 p471–478
(FTD-TT-63-518/1+2; AD-423599)

The design of an instrument for studying the anisotropy of the magnetic properties on monocrystals by the compensation method was developed, and the magnetic properties of beryllium monocrystals were investigated. It was shown that the temperature curve of the differences of main specific susceptibilities Δ_χ has a maximum close to 30° K. In addition, the form of the "periodic" dependence bending curve Δ_χ upon the magnetic field at 20.4° and 4.2° K was investigated, and new features in the form of the curve $\Delta_\chi(H)$ (H is the magnetic field) and its envelope were observed at 4.2° K. I.v.L.

N64-12842 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING THE DOSE-RATE DISTRIBUTION OF STRONG GAMMA SOURCES WITH A MICRODETECTOR CONSISTING OF A PLASTIC SCINTILLATOR AND PHOTOELEMENT
C. Hamann 4 Oct. 1963 21 p refs Transl. into ENGLISH from Kernenergie, no. 12, 1962 p 845–853
(FTD-TT-63-863/1+2) AD-423601)

This review presents discussions of the following areas: (1) the demands made on the measuring system; (2) the production of polystyrole plastic scintillators; (3) the construction of test probes consisting of a plastic scintillator and a selenium photo-element from the VEB Carl Zeiss Jena; (4) the calibration of the test probes; (5) the measurement of Co^{60} radiation installations; and (6) the investigation of the radiation resistance of the plastic scintillators. I.v.L.

N64-12846 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHODS OF THRESHOLD SIGNAL RECEPTION IN THE PRESENCE OF NOISE
J. Seidler 7 Oct. 1963 139 p refs Transl. into ENGLISH of an article from Przemyskowy Inst. Telekomunikacji, Prace (Poland), v. 11, no. 32/33, 1961 p 1–50
(FTD-TT-62-1389/1+2; AD-424402)

Analysis is based on decision functions theory. The concept of passive parameters is introduced to obtain mathematical models by taking into account the lack of knowledge concerning some signal parameters, thus giving more adequate description of the real signals. Consideration is given to the reception of signals transmitting discrete, continuously varying, or multidimensional (multiplexed) messages. Reception of radio and radar signals is discussed in detail. Optimum decision rule is found, and the quality of optimum decisions is calculated and compared with the quality of reception methods used in practice. The relationship between the conventional concept of signal-to-noise ratio and the concepts of decision theory is discussed. Author

N64-12852 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF HAZE OF AERIAL COLOR PHOTOGRAPHY
N. I. Bogachkov 28 Oct. 1963 15 p refs Transl. into ENGLISH of an article from Zhur. Nauch. i Priklad. Fotogr. i Kinematogr. (Moscow), v. 7, no. 2, 1962 p 112–120
(FTD-TT-63-798/1+2; AD-425405)

The factors which influence the effective contrast of the photographic material in aerial photography were determined. The coefficient, which characterizes the blur effect on the negative due to smoke in the air and the light dispersion in the optical system, was calculated for various conditions. Results are presented in tabular form. R.T.K.

N64-12853 Massachusetts U., Amherst Polymer Research Inst.
THE RELATIONSHIP BETWEEN THE CHANGE IN STRESS AND BIREFRINGENCE DURING THE CRYSTALLIZATION OF RUBBER DURING RELAXATION
W. Yau, K. Sasaguri, and R. S. Stein 28 Aug. 1963 18 p refs
(Contract Nonr-3357(01))
(ONR-TR-54; AD-425489)

Stress and birefringence are simultaneously measured during the relaxation (at constant length) of natural rubber vulcanizate at room temperature. At higher elongations, crystallization results in an enhanced decrease in stress and an increase in birefringence during the relaxation. An attempt is made to quantitatively correlate these observations utilizing the Flory theory of stress on crystallizing rubbers and the Kuhn–Treloar theory of birefringence of rubbery networks. Author

N64-12860 Emmanuel Coll., Boston, Mass.
MULTIPLE COHERENT SCATTERING OF OPTICAL RESONANCE RADIATION APPLIED TO THE 6^3P_1 LEVEL OF MERCURY, PART II: THEORY [ETUDE DE LA DIFFUSION MULTIPLE COHERENTE DE LA LUMIERE DE RESONANCE OPTIQUE. APPLICATION AU NIVEAU 6^3P_1 DU MERCURE. ETUDE THEORIQUE, DEUXIEME PARTIE]
J. P. Barrat Bedford, Mass., AFCRL Apr. 1963 40 p refs Transl. into ENGLISH from J. Phys. Rad. (Paris), v. 20, no. 6, 1959 p 633–646
(Contract AF 19(604)-8505)
(E-T-F-63-2; AD-415246)

The results obtained previously on the problem of multiple scattering of resonance radiation are applied to the case of *N* atoms in a vapor. The equations governing the time variation of the probability amplitudes of the excited states are solved by successive approximations with respect to the coupling

terms representing multiple scattering. By using geometrical approximations, the series obtained are summed up, and the results are expressed as functions of a single parameter x; x represents the probability of a photon emitted by one of the *N* atoms being absorbed by another before escaping from the resonance cell. The apparent lifetime ("coherence time") of the excited level, the degree of polarization of the resonance light, and the imprisonment time of the radiation are expressed as functions of x, for the different hyperfine sublevels of the mercury isotopes. Various approximations made in the calculation are also discussed. Author

N64-12913 Mound Lab., Miamisburg, Ohio
ACTINIUM
G. Bouissières 7 Feb. 1963 31 p refs Transl. into ENGLISH of the book "Nouveau Traité De Chimie Minérale, Tome VII" Paris, Masson et cie, 1960 p 1413–1446
(Contract AT(33-1)-GEN-53)
(MLM-1147(Tr)) OTS: $0.75

This review of actinium contains discussions of the following areas: (1) isotopes and nuclear properties; (2) preparation and purification; (3) electrolytic deposition; (4) physical and chemical properties; (5) identification and determination of Ac^{227}; (6) atomic weight; and (7) identified and unidentified compounds of actinium. I.v.L.

N64-12916 France. Office National D'Etudes Et De Recherches Aerospatiales, Chatillon-Sous-Bagneux
THE ASSOCIATION OF AN ELECTRICAL NETWORK WITHIN DIGITAL COMPUTERS FOR DETERMINATION OF ELECTRON TRAJECTORIES. APPLICATION TO IONIC PROPULSION [ASSOCIATION DU RESEAU ELECTRIQUE ET DES CALCULATRICES ARITHMETIQUES POUR LA DETERMINATION DES TRAJECTOIRES ELECTRONIQUES]
Christian Lerin [1963] 172 p refs In FRENCH; ENGLISH summary
(ONERA-TN-73)

In an ionic propulsor it is necessary to determine the trajectories of the particles from the emission electrode to define the efficiency and to modify, if necessary, the relative configuration of the electrodes. For this, an iterative method associating analog and digital computers is presented; the electrical potential inside the propulsor is simulated by the voltage of a resistance network whose boundary conditions and elements are adjusted, while the trajectories and the space charges are defined from the potential distribution by means of a digital computer. The principle of the method is checked with an example analytically computable, and a particular form of axially symmetrical propulsor is treated. Author

N64-12917 European Atomic Energy Community, Brussels (Belgium)
MEASUREMENTS OF THE CONDUCTIVITY AND POLARIZABILITY OF U AND UC AT OPTICAL FREQUENCIES
P. Camagni, A. Cingolani, and A. Manara Joint Nucl. Res. Center, Ispra Estab. (Italy), Oct. 1963 22 p refs
(EUR-463.e) Available from Belgian American Bank and Trust Co., N.Y., account No. 12186: 40 Belg. Fr.

The electrical conductivity and polarizability of uranium and uranium carbide have been measured at optical frequencies, by means of a technique based on the polarization of reflected light. Dispersion curves for both parameters have been determined in this way for the region of the spectrum going from ~0.35 μ to ~2.8 μ. The results are systematic enough to justify a certain comparison between the electronic structures of the two materials. The present data refer to polycrystalline specimens. Author

N64-12924 Carnegie Inst. of Tech., Pittsburgh, Pa.
THE ROLE OF PARTICLE-HOLE CORRELATION IN THE INELASTIC SCATTERING OF ELECTRONS FROM C^{12}, O^{16}, AND Ca^{40} Technical Report No. 13
Vincent Gillet and Michael A. Melkanoff (Calif. U.) Sep. 1963 37 p refs
(Contract NONR-760(15))
(AD-424383)

All available experimental data on the inelastic scattering of high energy electrons from C^{12}, O^{16}, and Ca^{40} have been analyzed in terms of the particle-hole models of nuclear excitations. The calculations do not involve any free parameters. The results proved quite sensitive to the treatment of nuclear correlations, and generally favored the random phase approximation, which yielded satisfactory agreement with most of the data. Author

N64-12928 Lincoln Lab., Mass. Inst. of Tech., Lexington
ENERGY-BAND CALCULATIONS
F. W. Quelle, Jr. (Ph.D. Thesis—Harvard U.) 17 Jan. 1963 51 p refs
(LL-TR-295; AD-405145)

The orthogonalized plane wave energy-band structure of a solid can be self-consistently determined by use of the method described in this report. In this method, correct core functions are of prime importance. A wholly automatic computer program carries out all operations, including the symmetry adaptation of the basis set. The operation of this program is illustrated by a calculation of the band structure of silicon, and a comparison is made between the calculated results and the results obtained from experiment. Sources of error giving rise to discrepancies between theoretical and experimental results are discussed, and suggestions are made for the remedy of these errors. Author

N64-12948* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMAGE CONSTRUCTION FOR CONCAVE GRATINGS AT GRAZING INCIDENCE, BY RAY TRACING
S. O. Kastner and W. M. Neupert Repr. from J. Opt. Soc. Am., v. 53, no. 10, Oct. 1963 p 1180–1184 refs
(Rept. NASA RP-91)

The images formed by a concave grating used at grazing incidence are constructed by a ray-tracing method. The method, equivalent to a recently developed procedure of Spencer and Murty, can be used for any configuration of grating and object. The results are compared with a third-order approximate theory for the case of rays parallel to the Rowland plane. Author

N64-12964 Atomic Energy Commission, New Brunswick, N.J.
SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JANUARY 1963 THROUGH JUNE 1963
A. R. Eberle et al Dec. 1963 78 p
(NBL-204) OTS: $1.75

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N64-12969 Chicago U., Ill. Inst. for the Study of Metals
THE ELECTRON THEORY OF SIMPLE METALS AND ALLOYS
Morrel H. Cohen [1963] 42 p refs Presented to the Spec. Session on Concentrated Solid Solutions of the Cleveland Meeting of the ASM, 21 Oct. 1963

Two separate but related aspects of the electron theory of metals and alloys are discussed. Attention is first given to a proper conceptual framework for describing the motion of individual electrons in metals and alloys, together with the problem of devising a reasonable approximation scheme for calculations relating to that framework. A brief review is given of the Bloch model, emphasizing particularly the dilemma posed by the contrast between its great empirical success and the apparent weakness of its underpinnings, followed by descriptions of the Landau quasi-particle theory and the pseudopotential. Finally, an explicit, simple form for the Bloch model is developed which includes electron correlation as well as crystal field effects. The second aspect of the electron theory relates to the understanding of certain empirical generalizations about the relative importance of conduction-electron density n, atomic composition c, and structure S for the properties of metals and alloys. The theory is put into a form which exhibits explicitly the separate dependence of properties on n, c, and S. Results are reviewed of recent approximate calculations which permit the interference that the relative importance of n, c, and S demanded by the empirical generalizations can be derived from the theory. C.L.W.

N64-12970 Atomic Energy of Canada, Ltd., Chalk River, Ontario
MEASUREMENT OF SMALL CONCENTRATIONS OF ARGON-41 IN AIR
G. Cowper, B. Banville, and A. S. Coveart Oct. 1963 8 p ref (AECL-1868; CRRD-1171) AEC of Canada: $0.20

Knowledge of the dispersal of radioactive aerosols from a reactor stack is necessary in order to assess the hazard to those in the environment following a reactor accident. The measurement of argon-41 in air, which is produced by neutron activation of atmospheric argon in reactor coolant channels, is a convenient means of determining dilution factors. The apparatus described used a detector consisting of thin plastic scintillators and is capable of detecting argon concentrations as small as 0.02×10^{-12} c/ml in the presence of background gamma radiation of up to 0.15 mr/h. Author

N64-12971 Nihon U., Tokyo (Japan) Coll. of Science and Engineering
COLLECTIVE EXCITATION OF UNLIKE PAIR STATES IN HEAVIER NUCLEI
Kiyomi Ikeda [1963] 40 p refs
(NUP-63-16)

The neutron-hole-proton pair ($\bar{n}$-p), correlations in heavier nuclei are studied by making use of the j-j coupling shell model. It is shown that the coherent states with even parity and nonzero spin are induced because of the ($\bar{n}$-p) repulsive interactions, with uppermost excitation energies which are not higher than the isobaric state $T_-|\psi_0\rangle$. The numerical calculation assuming the j-j coupling model with zero-range forces is carried out for the state with $J^\pi = 1^+$ of the nucleus Bi^{208} which can be produced by the (p, n) reaction using the target nucleus Pb^{208}. The transition strength due to the operator $Y_- = \sum_i \tau_{i-}\,\sigma_i$ concentrates in the higher energy region, although the spin-orbit splitting plays an important part in distributing the transition strength over the wider energy region. Author

N64-12972 Toronto U. (Canada) Inst. of Aerophysics
ANNUAL PROGRESS REPORT 163
Oct. 1963 132 p refs
(AD-423576)

The theoretical work on the transport of mass, momentum, and energy in tubes under free molecular conditions has been largely completed in the past year. A special aspect of this work was concerned with the application of cones as possible particle "scoops" for propellant accumulation in orbital vehicles. Calculations for the behavior of impact probes of arbitrary length and at arbitrary speed ratio have been made to extend the previously available results to cases of impact probes at angle-of-attack. Experiments at subsonic and supersonic speeds have been made to substantiate the theoretically predicted probe behavior. Experiments are in preparation in the Low Density Wind Tunnel, in which the electron gun technique will be used to study diffusive separation of argon-helium gas mixtures in an underexpanded supersonic free jet and normal shock waves. The review of the aerodynamics of highly rarefied gases and plasmas has been extended to include an assessment of experimental methods and computational procedures that are useful in the study of this subject. Author

N64-12982 Wisconsin U., Madison
THE BOUNDARY CORRESPONDENCE OF A QUASICONFORMAL MAPPING IN SPACE Technical Summary Report
D. A. Storvick Sep. 1963 11 p refs
(Contract DA-11-022-ORD-2059)
(MRC 426)

The nature of those domains in 3-space which can be mapped quasi-conformally onto the unit ball is investigated. It is proved that if a simply connected domain of finite volume and connected complement can be mapped quasi-conformally onto the unit ball then necessarily there must correspond to those boundary points of the domain which are accessible by a finite path, a set of measure 4π on the unit sphere. Author

N64-13008* Syracuse U., Research Inst., N.Y.
NOISE INVESTIGATIONS WITH IMPINGING JET FLOWS Status Report No. 1, 1 Jun.-30 Nov. 1963
Darshan S. Dosanjh Dec. 1963 10 p
(NASA Grant NsG-431)
(NASA CR-55144; ME-1085-63111) OTS: $1.10 ph, $0.80 mf

The current status of the program is as follows: (1) An extensive survey of existing experimental and analytical literature on or related to jet noise (especially from high-pressure-ratio jet flows) was undertaken, and pertinent literature was accumulated and studied. (2) It was determined that the tape-recorder recording and playback technique, in conjunction with the commercially available noise-analyzing equipment, will provide the required flexibility to cover experimentally an extended frequency range of noise-intensity distribution over wide operating conditions such as operating reservoir pressures, jet exit diameters, and flow times. (3) The proposed construction of an anechoic chamber has been accepted by Syracuse University. I.v.L.

N64-13016 General Electric Co., San Jose, Calif.
SODIUM COOLED REACTORS PROGRAM. FAST CERAMIC REACTOR DEVELOPMENT PROGRAM First Quarterly Report, Oct.-Dec. 1961
F. J. Leitz, ed. AEC Div. of Tech. Inform., 15 Aug. 1963 170 p refs
(Contract AT(04-3)-189)
(GEAP-3888) OTS: $2.75

Activities in the following areas are discussed: (1) Experimental Fast Ceramic Reactor (EFCR) design and planning—results of the physics analysis and the design of the fuel elements, core assembly, control mechanisms, reactor vessel, and shielding; (2) vented fuel development—evaluation of concepts to accommodate or relieve the pressure developed in fuel elements resulting from fission product gas release; (3) fuel testing in TREAT (Transient Reactor Test Facility)—a discussion of the design of the fuel and fuel capsules to be used in testing, the hazards analysis of the first series of tests, and the operating instructions; (4) mixed carbide fuel study—an evaluation of the potential for and the problems of applying plutonium–uranium carbide as a fast ceramic reactor fuel; (5) fuel fabrication development—determination of whether initially homogeneous mixed oxide is subject to segregation of the U and Pu oxide under the thermal gradients occurring during irradiation; and (6) reactor dynamics analysis and reference design—computer program for transient calculation, refined Doppler calculation, and effect of plutonium migration of Fast Ceramic Reactor Doppler reactivity. P.V.E.

N64-13024 Comitato Nazionale per L'Energia Nucleare, Frascati (Italy)
NONVANISHING PARAMAGNETIC SUSCEPTIBILITY IN SUPERCONDUCTORS AT ABSOLUTE ZERO
H. H. Nickle 15 Nov. 1963 6 p refs
(*Its* Nota Interna 219; LNF-63/71)

An explanation is suggested for explaining why a weak, uniform magnetic field can polarize the electron spins of a superconductor, and thus produce a Knight shift at zero temperatures. It is theorized that if the phenomenological BCS "effective potential" is attractive only near the Fermi surface [$k_F - (1/a)$ to $k_F + (1/a)$], then the electron states inside the sphere of radius $R = k_F - (1/a)$ can be completely filled at absolute zero with unpaired "normal" electrons, which give a nonvanishing contribution to the paramagnetic susceptibility of the superconductor. P.V.E.

N64-13032 Army Missile Command, Huntsville, Ala.
ON THE PLEONASMS IN THE GENERAL SOLUTION OF EQUILIBRIUM EQUATIONS OF AN ANISOTROPIC BODY IN DISPLACEMENT
E. N. Baida 13 Apr. 1963 19 p refs Transl. into ENGLISH from Izv. Vys. Uchebn. Zaved. Stro-vo I Arkh. No. 1, 27–37 (1959)
(RSIC-10; AD-404918) OTS: $1.60

A general solution is presented for a system of differential equilibrium equations in displacements of an anisotropic body during the absence of volumetric forces. J.E.T.

N64-13034 Pittsburgh U., Pa.
A STUDY OF RADIATION EFFECTS ON SOLIDS USING CYCLOTRON IRRADIATIONS Final Report
J. R. Townsend 14 Jun. 1963 35 p refs
(Contract AF-19(604)-3906)
(AFCRL-63-183; AD-424454)

This report briefly reviews work covered in more detailed reports on the two main areas studied: (1) calculation of an atomic interaction potential based on a detailed solution of the two-center Thomas–Fermi problem, and (2) the experimental study of the effects of deuteron irradiation on the electrical resistivity and on the mechanical Q and elastic modulus of tungsten. Author

N64-13044 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France
INCOMPATIBILITY OF THE EXACT AND APPROXIMATE BOOTSTRAP CONDITIONS IN A SOLUBLE MODEL
B. Diu and H. R. Rubinstein Dec. 1963 7 p refs

A model is considered in which solutions to the bootstrap theory can be obtained without considering one-particle exchange graphs to calculate the left-hand discontinuities. These "exact" solutions are compared with standard, "approximate" solutions. R.T.K.

N64-13047 Comitato Nazionale per l'Energia Nucleare, (Italy) Lab. Nazionali
KINEMATIC TABLES FOR PHOTOPRODUCTION OF A TWO-BODY SYSTEM
R. S. Jones 30 May 1963 52 p
(*Its* Nota Interna 202; LNF-63/40)

Kinematic tables are presented for photoproduction of a two-body system. R.T.K.

N64-13061* General Dynamics/Astronautics, San Diego, Calif.
CATALYSIS OF HYDROGEN ATOM RECOMBINATION Final Report
H. Girouard, F. M. Graber, and B. F. Myers 12 Feb. 1963 97 p refs
(NASA Contract NAS8-2534)
(NASA CR-52376; AE63-0078) OTS: $8.60 ph, $3.11 mf

About twenty materials have been tested for their effectiveness in catalyzing the recombination of hydrogen atoms.

For ten materials which underwent an overall, rapid, second order reaction with hydrogen atoms, evidence for catalytic activity has been found. This evidence was obtained by measuring the rate of hydrogen atom disappearance, determining the number of cycles of atom recombination in which each catalyst molecule was involved, and from observation of the pressure independence of rate constants. It is a deduction from experiment that potent activity is demonstrated at temperatures greater than 500° K. Activation energies, pre-exponential and steric factors have been obtained for the rapid overall reactions of hydrogen atoms with ethylene, allene, 1,3-butadiene, benzene, cis-butene-2, acetylene, propylene, and vinyl chloride. Particular attention was given to the contribution of surface phenomena; the assumption of a Langmuir type sorption isotherm was consistent with the experimental data and permitted the gas phase and surface reactions to be distinguished. Author

N64-13089 Southampton U. (Gt. Brit.) Inst. of Sound and Vibrations Research
THE PRACTICAL PROBLEMS OF ASSESSING DAMPING TREATMENTS
D. J. Mead May 1963 51 p refs Presented at the Acoust. Soc. of Am. Spring Meeting, N. Y., May 1963
(ISAV Memo. 102)

Consideration is given to systems under shock, periodic and random excitation. Special reference is made to jet and propeller excited vibrations of airplane structures (to the associated stress levels and transmitted noise) and also to vibrations excited by boundary layer pressure fluctuations. The manner in which some of these response quantities depend on the basic structural parameters (stiffness, damping and mass) is discussed, with a view to defining the most desirable characteristics of an artificially-damped structure. Criteria for assessing the effectiveness of damping treatments are developed. The limitations, in this respect, of the simple flexural loss factor become apparent. The estimation and measurement of the damping and stiffness of a treated reinforced plate structure are discussed. Author

N64-13090 Weapons Research Establishment (Australia)
THE VARIATION OF THE OPTICAL FREQUENCY RESPONSE OF THE ATMOSPHERE WITH SIGHTLINE ELEVATION
C. B. Rogers Jun. 1963 20 p refs
(OID-35)

A long steel tube lifted by a helicopter has been used to provide the line object for an optical system to study the change with elevation of the atmospheric spread function, from which the frequency response is calculated. It is shown that the atmosphere acts like a uniformly turbulent medium and gives rise to a spread function which follows a gaussian distribution. Author

N64-13097 Virginia U., Charlottesville School of Engineering and Applied Science
COMPOSITION DEPENDENCE OF NON-EQUILIBRIUM EFFECTS IN GAS PHASE REACTIONS
Chong Wha Pyun and John Ross (Brown U.) Nov. 1963 47 p refs Submitted for Publication
(Contract Nonr 3623(00); Proj. Squid
(BRN-9-P)

The process of a chemical reaction perturbs the translational and internal distributions of reactants and products; the composition and affinity dependences of the effects of the nonequilibrium distributions are derived for variously defined rate coefficients of reactions occurring in a dilute, homogeneous, and isothermal gas phase by a first order perturbation solution of appropriate Boltzmann equations. In general the ratio of forward to reverse rate coefficient differs from the equilibrium constant to the extent of the influence of the nonequilibrium distributions; one exception is the ratio of the apparent forward to reverse rate coefficient in the respective limit of infinite affinity for an isomerization or excitation reaction proceeding in large excess of inert gas. Detailed calculations are presented for this and some other simple cases including a bimolecular reaction of hard sphere molecules and a reaction with components in only two internal states. Author

N64-13111 Michigan U., Ann Arbor Inst. of Science and Tech.
ELASTIC AND ACOUSTIC WAVES RADIATED FROM CYLINDRICAL MEDIA ABOUT A POINT SOURCE
W. C. Meecham and John M. De Noyer Nov. 1963 24 p refs
(Contract AF 49(638)-1170; Contract AF 19(604)-6642)
(Rept. 5178-14-T/3649-23-T; AD-423016)

The theory for three related but different problems is considered. These problems involve finding the radiation pattern from simple harmonic sources in various types of media geometries which can be represented by cylindrical surfaces. The first problem is a consideration of a point source on the axis of an elastic circular cylinder which is completely surrounded by an infinite elastic medium of different properties. The second and third problems are acoustic or two-fluid problems. A free surface has been introduced in both these examples. The source region for the second problem is a fluid half cylinder with the free surface containing the axis of the cylinder and the source located below the axis. The last problem involves a truncated fluid cylinder with the axis normal to the free surface. No numerical values have been obtained for the formal solutions presented here. Author

N64-13115 Army Materials Research Agency, Watertown, Mass. Materials Research Lab.
A SIMPLE PROBLEM IN ANHARMONICITY
R. J. Weiss Oct. 1963 12 p refs
(AMRA-TR-63-20; MRL-137; AD-422682)

The eigenvalues of the one-dimensional coupled oscillators are evaluated for cubic and quartic perturbations, and these yield energy terms that include products of the quantum numbers of the two normal modes. The spacing between levels are broadened in energy by ~20 percent. A partition function derived from the Morse potential is proposed to evaluate the thermodynamic properties of a real crystal. Author

N64-13117 Stanford U., Calif.
SEQUENTIAL TEST FOR THE MEAN OF A NORMAL DISTRIBUTION III (SMALL t)
Herman Chernoff 21 Oct. 1963 54 p refs
(Contract Nonr-225(52)
(AD-424788; Tech. Rept. 90)

Asymptotic expansions are derived for the behavior of the optimal sequential test of whether the unknown drift μ of a Wiener–Levy process is positive or negative for the case where the process has been observed for a short time. The test is optimal in the sense that it is the Bayes test for the problem where there is an *a priori* normal distribution of μ, the regret for coming to the wrong conclusion is proportional to $|\mu|$, and the cost of observation is one per unit time. The Bayes procedure is compared with the best sequential likelihood ratio test and with the procedure which calls for stopping when no fixed additional sampling time is better than stopping. The derivations allow for generalizing to variations of this problem with different cost structure. Author

N64-13129 Chicago U., Ill. Molecular Structure and Spectra Lab.

MOLECULAR STRUCTURE AND SPECTRA Quarterly Summary Report, 1 Jul.-30 Sep. 1963

C. C. J. Roothaan 1963 8 p

(Contract DA-11-022-ORD-3119; ARPA Order 368)

(AD-423022; Rept. 17)

Activities are reported in the following areas: (1) analytic atomic SCF (self-consistent field) computer program, (2) numerical atomic SCF computer program, (3) homonuclear and heteronuclear diatomic SCF computer programs, (4) polyatomic one-center and two-center expansion SCF computer programs, (5) atomic and molecular integrals package computer program, (6) calculations on atoms, and (7) calculation of diatomic molecules. R.T.K.

N64-13135 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.

INHOUR, AN IBM-7090 CODE FOR THE COMPUTATION OF THE ROOTS OF THE INHOUR EQUATION

H. A. Larson and W. A. Christenson 20 Aug. 1963 51 p refs

(Contract AT(10-1)-205)

(IDO-16904) OTS: $1.25

This code solves for the roots of the inhour equation using, as input, mean prompt neutron generation time, reactivity in the form of dollars, and as many as twenty delayed neutron groups. The program uses Newton's method to determine the roots with an optional convergence criterion. Included in this report are parametric studies of the roots and residues associated with a solution of the time dependent reactor kinetics equations for a step input of reactivity. These parametric studies are treated individually for four mean prompt neutron generation times and six delayed neutron groups. Also included is a study of the numerically largest root of the inhour equation with 15 delayed neutron groups and positive reactivity as input. Author

N64-13137 Oak Ridge National Lab., Tenn.

MOLTEN-SALT REACTOR PROGRAM Semiannual Progress Report, for Period ending 31 Jul. 1963

R. B. Briggs 7 Jan. 1964 157 p refs

(Contract W-7405-eng-26)

(ORNL-3529) OTS: $2.75

Progress was reported for a molten salt reactor (MSRE) program. Emphasis was directed towards the following areas: molten salt reactor design, procurement and construction; component development, reactor analysis, metallurgy and radiation effects; and the chemistry of fuel and fuel processing. C.L.W

N64-13140* Chicago U., Ill

PROPERTIES OF A THIN HOLLOW SUPERCONDUCTING CYLINDER

D. H. Douglass, Jr. Repr. from Phys. Rev., v. 132, no. 2 15 Oct. 1963 p 513–521 refs

(NASA Grant NsG-352)

The properties of a thin, superconducting cylindrical tube are considered by means of the Ginsburg–Landau theory. The equations have been solved under the condition that the magnitude of the energy gap (order parameter) is independent of position but not independent of magnetic field H_0 or of fluxoid quantum number n. This latter dependence on H_0 and n, which is usually ignored, is found to lead to modification of the expressions for the various superconducting properties. In the limit $rd/\gamma^2 \leq 1$, where r is the radius, d the thickness, and γ the penetration depth, the energy gap goes smoothly to zero with magnetic field for a fixed n, defining a second-order phase transition. The magnetization, the current density, and the free energy also go smoothly to zero, with the curves for different n being displaced by n times the field corresponding to unit quantum. In the limit $rd \geq \gamma^2$, the energy gap drops discontinuously to zero at critical conditions, giving a first-order phase transition, with a corresponding influence on the other properties of the superconductor; also the possibility of a thermodynamically metastable region with respect to the normal state arises. Author

N64-13141 European Atomic Energy Community, Brussels (Belgium)

INVESTIGATION ON INTERNAL FRICTION AND THE DYNAMIC ELASTIC MODULUS OF SAP-ISML [CONTRIBUTO ALLO STUDIO DELLA DISSIPAZIONE INTERNA E DEL MODULO ELASTICO DINAMICO DEL SAP-ISML]

T. Federighi and D. Gelli (1st. Sper. Metal. Legeri) Oct. 1963 37 p refs In ITALIAN; ENGLISH Summary Presented at the Journees Metallurgiques d'Automne, Paris, 15–19 Oct. 1962

(EUR-402.i) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 50 Belg. Fr.

Dynamic elastic modulus (resonance frequency) and internal friction measurements have been carried out on SAP-ISML with the double purpose of (1) making an attempt to clarify the mechanism of internal friction of this material and (2) obtaining more information on its general structural properties. Measurements have been carried out between 20° and 500° C, in the kilocycle frequency range, employing a Bordoni-type apparatus. The measurements confirm that SAP in the cold worked state inherently maintains the properties of cold worked materials despite any subsequent annealing treatment. Author

N64-13142 European Atomic Energy Community, Brussels (Belgium)

ON THE CORRECTION FACTORS AFFECTING THE EVALUATION OF THE BETA TOTAL RADIOACTIVITY OF FISSION PRODUCTS [SUR LES FACTEURS DE CORRECTION AFFECTANT L'EVALUATION DE LA RADIOACTIVITE DETA TOTALE DES PRODUITS DE FISSION]

P. Gaglione and E. Van Der Stricht Joint Nucl. Res. Center, Ispra Estab. (Italy), Oct. 1963 86 p in FRENCH; ENGLISH summary

(EUR-424.f) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 125 Belg. Fr.

Data are presented which make possible the precise evaluation of the B activity of fission products measured in a variety of conditions of absorption and self-absorption. The correction factors to apply to the B measurement of fission products when the counter has been standardized with potassium 40 or with thallium 204 have been tabulated. Nomograms for computing self-absorption and absorption correction factors of B emitters are presented. Author

N64-13143 European Atomic Energy Community, Brussels (Belgium)

ALPHA RATEMETER WITH SOLID STATE DETECTOR

V. Mandl and L. Oliveira Joint Nucl. Res. Center, Ispra Estab. (Italy), Oct. 1963 11 p

(EUR-429.e) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 25 Belg. Fr.

A portable alpha monitor with solid state detectors is described. The full scale range is of 1000 PPS and an auditive indication is also provided. The battery life is about 70 hours. The instrument operates correctly in a gamma field up to 8 r/h. Author

N64-13145 European Atomic Energy Community, Brussels (Belgium)
USE OF RADIOISOTOPES HAVING COMPLEX FORMATION AND DECAY SCHEMES IN ACTIVATION ANALYSIS [UTILISATION DANS L'ANALYSE PAR ACTIVATION DE RADIOISOTOPES AYANT DES LOIS DE FORMATION ET DE DECROISSANCE COMPLEXES]
F. Girardi, G. Guzzi, and J. Ley Joint Nucl. Res. Center, Ispra Estab. (Italy), Oct. 1963 34 p refs In FRENCH; ENGLISH Summary
(EUR-467.f) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 50 Belg. Fr.

The growth and decay curves of radioisotopes formed by double beta decay or isomeric transition have been studied with a view to using these isotopes in activation analysis without the necessity of irradiating a standard each time. Two FORTRAN programs have been set up, and an electronic computer IBM 7090 has been used for the calculations required. Author

N64-13146 European Atomic Energy Community, Brussels (Belgium)
THEORETICAL ANALYSIS OF SOME PROBLEMS WHICH ARE DUE TO THE PRESENCE OF PLUTONIUM IN HETEROGENEOUS THERMAL REACTORS
E. Diana Joint Nucl. Res. Center, Ispra Estab. (Italy) Oct. 1963 20 p refs
(EUR-470.e) Available from Belgian American Bank and Trust Co., Account No. 121.86: 40 Belg. Fr.

Oscillation experiments with Pu-containing fuel elements are planned for the ECO reactor at the ISPRA JRC in the near future. The influence of plutonium on the spectrum as well as the fuel of the moderator has been measured; from these measurements it is possible to calculate the reactivity of the irradiated lattices. The effects of nonuniform spatial distribution of the plutonium in the fuel were also studied. The values of the various fuel parameters for such a fuel were estimated. Author

N64-13147 Purdue Research Foundation, Lafayette, Ind.
STRUCTURE OF GROUPS OF MAPPING CLASSES Final Report
Arthur H. Copeland, Jr. [1963] 2 p Submitted for Publication
(Contract DA-ARO(D)-31-124-G147)
(AROD-2663-4; AD-420245)

A study of the isotopy of finitely triangulable spaces and the adaption of homology theory to such a context are discussed. During this period the isology of cones was studied. P.V.E.

N64-13152 Boeing Scientific Research Labs., Seattle, Wash.
A NOTE ON REGULAR PERTURBATION THEORIES
F. E. Bisshopp Nov. 1963 29 p refs
(DI-82-0316)

A formalism, closely related to Fredholm's resolvent, is developed which has an infinite radius of convergence. This formulation shares with the formalism derived directly from the Fredholm resolvent (Morse and Feshbach) the disadvantage of being cumbersome in its application. Therefore, an asymptotic approximation to the result was also developed. A relatively simple procedure for evaluating the result of a formulation which is unrestricted with regard to radius of convergence was obtained. The close relation between the theory described and Feenberg's formulation of regular perturbation theory is discussed. R.T.K.

N64-13159 West Virginia U., Morgantown
ABSORPTION SPECTRUM OF Cs IN THE PRESENCE OF ISOMERIC HYDROCARBONS
Oleg Jefimenko and Reginald J. Exton Repr. from J. Chem. Phys. v. 30, no. 1, 1 Jul. 1963 p 229–235 refs

The satellite bands and the shifts of the Cs lines in the spectra of Cs-hydrocarbon mixtures were studied. The hydrocarbons were isomers of butene (butene-1, butene-2, isobutene), butane (*n*-butane, isobutane), pentane (*n*-pentane, isopentane, neopentane), and hexane (*n*-hexane, 3-methylpentane, 2,3-dimethylbutane, neohexane). Four different types of satellite bands were observed. The shifts of high members of the Cs principal series extrapolated to relative density 1 were 41, 47, 47, 48, 55, 58, and 61 cm^{-1} for *n*-pentane, isopentane, *n*-hexane, 3-methylpentane, 2,3-dimethylbutane, neopentane, and neohexane, respectively. The results of simultaneous measurements of the band positions and shifts of high members of the Cs principal series suggest that the positions of the high-intensity red satellite bands are determined primarily by the effective cross sections of foreign-gas molecules for slow electrons rather than by the mass or polarizability of these molecules as thought previously. Author

N64-13171 Union Carbide Nuclear Co., Oak Ridge, Tenn.
TOOLING DEVELOPMENT FOR VERY HIGH PRESSURE PRESSING
R. P. Levey, Jr. and R. L. Huddleston 10 Jan. 1964 38 p Presented at the Gordon Conf. on Very High Pressure Res., 28 Jun. 1963
(Contract W-7405-eng-26)
(Y-DA-470) OTS: $0.75

Tooling has been designed for industrial-type operations over a pressure range to 70,000 atm (70 Kb). This tooling is hydraulically actuated by submersion in a pressure field up to 2000 atm. The efficiency of these designs is limited, primarily, by the strength of known or available materials. Present efforts have been directed toward improving this efficiency. Author

N64-13174 Columbia U., N.Y. Nevis Labs.
RESONANT PHENOMENA IN STRANGE-PARTICLE PRODUCTION
Uriel Nauenberg (Ph. D. Thesis) May 1963 75 p refs
(Contract AT(30-1)-1932)
(R-363; CU-218; NEVIS-112)

In an exposure of propane to 2.0 Bev/c π^- mesons at the Cosmotron in the Columbia 30-in. chamber, reactions where three particles are produced were analyzed for resonances between any two particles in the final state. The reactions studied were sufficiently overdetermined to permit a separation of hydrogen events from carbon. Definite evidence was found for resonant peaks in the $\Lambda\pi$ system (Y_1^*) with $M_0 = 1392 \pm 7$ Mev and $\Gamma/2 = 40 \pm 10$ Mev; in the $K\pi$ system (K^*) with $M_0 = 897 \pm 10$ Mev and $\Gamma/2 = 30 \pm 10$ Mev. The 1404 and 1525 $\Sigma\pi$ resonances were also observed. The data indicate that the Y_1^* has spin 3/2 and its parity is even. Author

N64-13175 Comitato Nazional per l'Energia Nucleare, Frascati (Italy) Lab. Nazionali
DESIGN CRITERIA OF THE AMPLIFIERS FOR THE RADIO FREQUENCY SYSTEM OF ORBITAL ACCELERATING MACHINES IN CONNECTION WITH RECENT ADVANCEMENTS OF RADIO ENGINEERING [CRITERI DI PROGETTO DEGLI AMPLIFICATORI PER GLI IMPIANTI A RADIOFREQUENZA DELLE MACCHINE ACCELERATRICI ORBITALI IN RAPPORTO AL RECENTI PROGRESSI DELLA RADIOTECHNICA]
D. Fabiani 29 Sep. 1963 5 p refs in ITALIAN
(LNF-63/64; *Its* Nota Interna 214)

The radiofrequency system is one of the most important parts of an orbital machine for analytical study. A frequency band in which a radio frequency system can operate is given as: $\Delta f = f_0 x \Delta r/r$, where Δf is the interval of variation of the working frequency, f_0, and r is a radial dimension of the ring.

Trans. by P.F.E.

N64-13176 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy) Lab. Nazionali

POSSIBLE DETERMINATION OF THE CHARACTER OF THE HIGHER RESONANCES IN PION-PHOTOPRODUCTION AND PROTON COMPTON EFFECT BY USING POLARIZED GAMMA RAYS

A. Verganelakis 31 Oct. 1963 13 p refs

(LNF-63/66; *Its* Nota Interna 216)

This analysis of the character of higher resonances in pion-photoproduction is made in terms of angular momentum states. The center of mass differential cross section for pion-photoproduction by polarized photons is written in terms of angular momentum states. Two cases of photon polarization are considered: polarization perpendicular ($\phi = 90°$) or parallel ($\phi = 0°$) to the production plane. The corresponding cross section $d\sigma_\perp/d\Omega$ and $d\sigma_\parallel/d\Omega$ are studied. The proton Compton effect is considered for further confirmation of the nature of the resonances as determined by the above analysis. I.v.L.

N64-13177 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy) Lab. Nazionali

CALCULATIONS BY MEANS OF OPTICS OF TRANSFER OF THE POSITRONS IN THE LINEAR ACCELERATOR OF FRASCATI [CALCOL PER L'OTTICA DI TRASPORTO DEI POSITRONI NELL'ACCELERATORE LINEARE DI FRASCATI]

E. Ferlenghi and L. Mango 11 Nov. 1963 30 p refs in ITALIAN

(LNF-63/70; *Its* Nota Interna 218)

The use of an optical system for studying the transfer of positron beams from a target convertor through a linear accelerator to an accumulation ring is discussed. The study is based principally upon the calculations by F. Amman, R. Andreani, and by the Varian Associates. Trans. by P.F.E.

N64-13178 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy) Lab. Nazionali

DESIGN ELEMENTS AND STATE OF ADVANCEMENT OF A 2.5-5 Mev MICROTRON MODEL [ELMENTI DI PROGETTO E STATO DI AVANZAMENTO DI UN MODELLO DI MICROTRONE (2.5-5 MeV)]

U. Bizzarri, M. Conte, R. Habel, and A. Vignati 28 Nov. 1963 11 p refs in ITALIAN

(LNF-63/73; *Its* Nota Interna 221)

The development of the microtron (2.5 to 5.0 Mev) is given. Future developments, which include microtron operation at 10.0 to 30.0 Mev energy levels and microtrons capable of accelerating positrons, are discussed.

Trans. by P.F.E.

N64-13182* Alabama U. Research Inst., Huntsville

ON THE EFFECT OF WRINKLES ON THE REFLECTIONS BY A SPHERE Research Report No. 7

F. J. Tischer Sep. 1963 11 p Presented at the 5th Intern. Symp. on Space Technol. and Sci., Tokyo, 2-7 Sep. 1963 (NASA Grant NsG-381)

(NASA CR-55163) OTS: $1.60 ph; $0.80 mf

Scattering of microwaves by a wrinkled spherical surface is considered. A rigorous formulation of the problem is considered. Approximate solutions based on geometrical and physical optics are presented. Author

N64-13194 Iowa State U. of Science and Tech., Ames Ames Lab.

THE CRYSTAL STRUCTURE OF SODIUM HYDROGEN FLUORIDE

James Edward Benson and D. R. Fitzwater May 1963 64 p refs

(Contract W-7405-eng-82)

(IS-678) OTS: $1.50

The structure of $NaHF_2$ has been reinvestigated in order to determine, as accurately as possible, the F-F distance in this crystal. The distance has been found to be 2.273 ±0.004A and is the same, within experimental error, as that found in ammonium and potassium bifluoride. The $NaHF_2$ crystal has been found to contain a feature that makes it useful as a check on any method for correcting the intensity of a reflection for white radiation streaking. The necessity for making such a correction is illustrated, and one method is examined which was found to give the intensity of a peak due to white radiation streaking to within 10% of the intensity actually observed. Author

N64-13200 Los Alamos Scientific Lab., N. Mex.

LAMPRE PROGRAM QUARTERLY STATUS REPORT FOR PERIOD ENDING NOVEMBER 20, 1963

Dec. 1963 21 p

(Contract W-7405-eng-36)

(LAMS-3021) OTS: $0.50

The current status of the LAMPRE program includes the following: (1) A study is being made to evaluate the possibility of using overlapping neutron energy groups for fast reactor calculations. (2) A code has been developed for computing the activities of fission-product chains in a circulating coolant loop. (3) Several Monte Carlo codes have been acquired and modified for use on the IBM-7090 computer for shielding-study purposes. (4) The metallographic examination of LAMPRE capsule 1454 has been completed and shows severe wall thinning at the liquid leve. (5) One hundred fourteen capsules for Core III of LAMPRE were made from arc-melted, high-purity Ta billey K658. (6) Differential thermal analysis has been completed on five alloys of the Pu-Mn-Ce system which have an approximate constant Pu concentration of 3 g Pu/cm^3. Also, the status of liquid-metals technology, the core test facility, and phase studies of Pu alloys is presented. I.v.L.

N64-13201 Brookhaven National Lab., Upton, N.Y.

NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT, JANUARY 1-APRIL 30, 1963

Jean H. Reynolds, ed. [1963] 116 p refs

(BNL-799(S-64)) OTS: $2.25

Research activities of the following divisions are summarized: (1) reactor physics; (2) chemistry and chemical engineering; (3) radiation; (4) hot laboratory; (5) metallurgy; and (6) engineering. P.V.E.

N64-13207 Comitato Nazionale per l'Energia Nucleare, Rome (Italy)

THE MUON - PAIR PHOTOPRODUCTION EXPERIMENT

A. Alberigi Quaranta, M. De Pretis, G. Marini, A. Odian, and G. Stoppini et al Jun. 1963 92 p refs ITALIAN Summary

(RT/F1(63)37)

The object of this report is to provide, as systematically as possible, all experimental details of the μ-pair photoproduction experiment carried out with the Frascati 1.0 Gev electron synchroton. The experiment consists of the measurement of the absolute cross section (for several energies of the incident γ-ray) of the process $\gamma + C \rightarrow \mu^+ + \mu^- + C$. Author

N64-13209 Lockheed-Georgia Co., Marietta
PRESSURE PROFILE GENERATED FROM A SUBMERGED ELECTRICAL SPARK Final Report
W. W. Watts 27 Mar. 1963 13 p
(GMRI-644.00)

The purpose of this investigation was to investigate various EDF electrode configurations and the resulting pressure profiles generated, thus providing data useful for electrode application to different part configurations. Two methods of approach were used in this investigation: motion picture study utilizing a fast exposure rate motion camera (15,000 pictures per second) and a Kistler transducer capable of indicating pressures from 0 to 300,000 psi. Due to work schedules of higher priority, this investigation was suspended short of any substantial results. Author

N64-13211 California U., Berkeley. Lawrence Radiation Lab.
A TECHNIQUE FOR MEASURING NEUTRON SPECTRA IN THE RANGE 2.5 TO 30 MeV USING THRESHOLD DETECTORS
John Clayton Ringle (Thesis) 11 Oct. 1963 229 p refs
(Contract W-7405-eng-48)
(UCRL-10732) OTS: $3.00

Threshold detectors are used as the energy-dependent neutron detectors, with the restriction that after the threshold reaction has occurred the residual nucleus must emit a gamma ray. The activity of each detector is the n determined by counting it with a NaI(Tl) scintillation crystal. Threshold reactions for (n,p) (N,a), and (n,2n) are used, and the criteria for the detectors are established. The existing literature and the periodic chart of elements were examined, and 29 threshold reactions were found which satisfied these criteria. Since the measured cross-section data available for most of these threshold reactions are sparse, these cross sections were calculated on the basis of the continuum model of the nucleus. These calculated cross sections agree well with the experimental data. Author

N64-13217 California U., Berkeley. Lawrence Radiation Lab.
STUDIES IN NUCLEAR SPECTROSCOPY BY TWO-NUCLEON TRANSFER REACTIONS
Richard H. Pehl (Ph. D. Thesis) 28 Aug. 1963 164 p refs
(Contract W-7405-eng-48)
(UCRL-10993) OTS: $2.75

Alpha particle energy spectra from (d,α) reactions on Li^6, Be^9, C^{12}, N^{14}, and O^{16} have been obtained using 24-Mev deuterons. The development of a high-resolution semiconductor E—dE/dx counter telescope made possible the observation of alpha particle groups arising from the formation of final states of higher excitation than previously studied by this reaction. Angular distributions corresponding to resolvable final states are presented. Marked variation in the relative cross sections of final states was observed in most of the alpha particle energy spectra. In an effort to explain the nature of this preferential population these final states are correlated, where possible, with their expected configurations. The removal of two nucleons from the target nucleus should favorably excite levels whose configuration is two holes relative to the target configuration. Author

N64-13218 California U., Berkeley. Lawrence Radiation Lab.
THE STRUCTURE OF HEAVY NUCLEI: A STUDY OF VERY WEAK ALPHA BRANCHING
Charles Michael Lederer (Ph.D. Thesis) 27 Sep. 1963 97 p refs
(Contract W-7405-eng-48)
(UCRL-11028) OTS: $2.00

Very weak alpha branching in heavy elements was studied by a recently developed coincidence technique. This technique makes it possible to measure the energies and intensities of both α-particle groups and deexciting radiation, even when the transition intensities are as low as 10^{-9} relative to the most intense alpha group. Twenty α-particle emitters from Po^{214} to Fm^{254} have been examined. The 00+ states ("beta vibrations") were observed in six even-even nuclei, and analogous states were found in three odd-mass nuclei. They are in general characterized by low alpha-decay hindrance factors and roughly equal deexcitation by electric monopole and quadrupole transitions. However, the deexcitation of these states is in disagreement with vibrational model predictions in certain cases; more important, the deexcitation and other properties of the states exhibit some irregular variations from nucleus to nucleus which are evidence for some particle character in the states. Information was also obtained about some other types of levels. Author

N64-13220 Los Alamos Scientific Lab., N. Mex.
SEMIANNUAL STATUS REPORT OF THE LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM FOR PERIOD ENDING OCTOBER 20, 1963
Nov. 1963 129 p
(Contract W-7405-eng-36)
(LAMS-3004) OTS: $2.50

The current status of the following areas is presented: (1) Picket Fence II B; (2) Picket Fence III—electron detector; (3) Picket Fence III—ion-particle detection; (4) a new gun on Picket FenceIII; (5) high-density plasma focus; (6) blackboard capacitor studies; (7) the emission of cyclotron radiation from a pulse ion-generator discharge; (8) the enhanced scattering of light by free electrons; (9) Scylla IV; (10) O VIII Lyman spectrum from Scylla; (11) the ultraviolet spectra; (12) axial injection studies; (13) transverse magnetic-field injection; (14) the magnetic field produced by a pair of crossed, rectangular mirror coils; (15) a test for a minimum point of a magnetic field; (16) the stabilization of a mirror-type field by adding a quadrupole field; and (17) component development. I.v.L.

N64-13225 Princeton U., N.J. Plasma Physics Lab.
MOMENTUM DISTRIBUTION IN THE GROUND STATE OF THE ONE-DIMENSIONAL SYSTEM OF IMPENETRABLE BOSONS
A. Lenard 24 Sep. 1963 64 p refs
(Contract AT(30-1)-1238)
(MATT-223)

An exact analytical formula may be given for the ground state wave function of a system of one-dimensional impenetrable bosons. Starting with this formula, a mathematically rigorous analysis is given which leads to the determination of major features of the momentum distribution in the limit of an infinitely large system. Author

N64-13226 Ling-Temco-Vought, Inc., Dallas, Tex. Research Center
PLASMA PHYSICS AND SPECTROGRAPHIC METHODS OF ANALYSIS
Jim Howard Johnson and Jerry F. Jaggers [1959] 21 p refs
(RE-OR-4)

Hydrogen, for example, ionizes at elevated temperatures, and an electron is removed. This electron may now recombine with a proton in any one of the possible atomic states

of hydrogen, and as the electron moves in toward its n = 1 orbit, electromagnetic radiation is emitted. This emission of separate energies of radiation is most easily studied using an optical grating spectroscope. Each atom has a characteristic set of lines, and the resulting spectrum may be used for a chemical analysis, for a study of fundamental processes, and for the measurement of plasma properties, chiefly temperature and particle velocity. But the presence of an electric field causes a change in the normal spectrum of a gas. However, once the average value of the electric field and subsequently the electron density are determined, the plasma temperature can be calculated. The method described in this report for analyzing the electric field effect and for calculating the temperature of the plasma is valid for partially ionized gases near thermal equilibrium and thus demands pressures near or just below atmospheric pressure for temperatures on the order of 10,000° K. I.v.L.

N64-13234 European Atomic Energy Community, Brussels (Belgium)

FAST NEUTRON SPECTROMETRY IN PILE BY THRESHOLD DETECTORS

M. Bresesti, A. M. Del Turco, A. Ostidich, A. Rota, and G. J. Segre Joint Nucl. Res. Center, Ispra Estab. (Italy), 1963 43 p refs

(EUR-289.e) Available from the Belgian American Bank and Trust Co., N.Y., account No. 121.86: 60 Bel. Fr.

Description is given of experiments carried out in a heavy water reactor (Ispra 1) and a swimming pool (Avogadro RS 1) reactor. Use has been made of detectors showing a reaction cross section of threshold type. The following reactions have been chosen: Np-237 (n,f); U-238 (n,f); Th-232 (n,f); S-32 (n,p) P-32; Ni-58 (n,p) Co-58; Al-27 (n,p) Mg-27; Fe-56 (n,p) Mn-56; Al-27 (n,a) Na-24. Description is given of the methods used for the determination of the reaction rate by beta or gamma activity measurements. Comparison is reported of two methods suitable for the fission rate determination. From the activation data by different elaboration methods fast neutron distribution spectra have been calculated; a new method has been proposed. Critical comparison of these methods has been made. The experimental data elaboration has been carried out using an IBM 7090 digital computer. Author

N64-13240 Columbia U., New York, N.Y.

MICROSTRUCTURE IN LINEAR ELASTICITY

R. D. Mindlin Oct. 1963 70 p refs

(Contract Nonr-266(09)

(Tech. Rept. 50; AD-424156)

A linear theory is presented of a three-dimensional, elastic continuum which has some of the properties of a crystal lattice as a result of the inclusion, in the theory, of the idea of the unit cell. The equations yield wave-dispersion relations, with acoustic and optical branches of the same character as those found at long wavelengths in crystal lattice theories and observed in neutron-scattering experiments. C.L.W.

N64-13242 Illinois U., Urbana

A COOPERATIVE PROGRAM OF FUNDAMENTAL RESEARCH AS RELATED TO JET PROPULSION OFFICE OF NAVAL RESEARCH, DEPARTMENT OF THE NAVY

S. L. Soo and R. C. Dimick Virginia U., Charlottesville, Nov. 1963 22 p refs To be presented at the 10th Intern. Symp. on Combustion

(Contract Nonr-3623(00); Proj. Squid)

(ILL-12-P; AD-424859)

Consideration of equilibrium of ionization of a gas-solid suspension shows that the solid particles will always become positively charged if the ionization of the gaseous atoms is negligible. However, the combination of high value of thermionic potential and low value of ionization potential of the gas may leave the solid particles negatively charged. Experiments with an arc flame of argon show that addition of metals tends to increase the recombination rate whereas oxides tend to decrease the recombination rate of argon. Author

N64-13259 Emmanuel Coll., Boston, Mass. Research Language Center

A MASS SPECTROMETER FOR INVESTIGATING THE PROCESSES WHICH OCCUR WHEN ELECTRONS AND IONS COLLIDE WITH MOLECULES [MASS SPEKTROMETR DLIA ISSLEDOVANIIA PROTSESSOV, PROISKHODIASHCHIKH PRI STOLKOVENIIAKH ELEKTRONOV I IONOV S MOLEKULAMI]

E. L. Frankevich and V. L. Tral'roze Mar. 1963 16 p refs Transl. into ENGLISH of an article from Pribory i Tekh. Eksperimenta (USSR), No. 2, 1957 p 48–53

(Contract AF 19(604)-8505)

(E-T-R-63-7; AD-414739) OTS: $1.60

A description is given of a mass spectrometer that makes it possible to measure accurately the appearance potentials and the initial reciprocating energy of ions. The appearance potential is measured by the "quasimono chromatization" of electrons (proposed by Fok), and the initial kinetic energy of the ions is determined by the retarding potential method. Appearance curves obtained by using this mass spectrometer are included for: (1) NH_3^+, H_2S^+, $C_3H_8^+$, $C_2H_2^+$, and H_2O^+ molecular ions; (2) secondary H_3O ions; and (3) molecular CH_4^+ ion and CH_3^+ fragment ion in the mass spectrum of methane. Curves of retardation are given for: (1) C^+ from CO; (2) H_2O^+ without an extracting field; and (3) H_2O^+ with an extracting field. R.T.K.

N64-13277 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

THE RELATIVE SIGNS OF PHOSPHORUS-PROTON NUCLEAR MAGNETIC RESONANCE COUPLING CONSTANTS

Stanley L. Manatt, Gordon L. Juvinall, and Daniel D. Elleman Repr. from J. Am. Chem. Soc., v. 85, Sep. 1963 p 2664–2665

(NASA Contract NAS7-100)

(NASA CR-53008; JPL-TR-32-485)

The relative signs of phosphorus-proton nuclear magnetic resonance coupling constants were investigated in: (1) diphosphine, (2) triethylphosphine, (3) methylphosphine, (4) dimethylphosphine, and (5) trivinylphosphine. Results are as follows: The P-C-H type coupling is relatively small (except in the case of (5)), and this geminal coupling must be the result of near cancellation of two or more terms of different signs, and could possibly include two major terms of different signs due to the Fermi contact mechanism, spin-orbital interaction terms, and electron-dipole interaction terms. Increased alkyl substitution appears to reduce the magnitude of the H-C-P coupling in the case of (3). It is possible that in (2) the sign of this coupling has been inverted relative to that of the H-C-C-P coupling by the presence of three ethyl groups on phosphorus. The results in (1) and (5) are suggestive of such inversion. It is suspected that in ethylphosphine the P-C-H coupling is about 1 to 2 cps and of the same sign as the P-C-C-H coupling. The major contributions to the H-C-C-H, H-P-C-H, and H-P-P-H couplings are expected to be similar, and thus these couplings should be of the same sign. The sign of the H-C-C-H coupling has been

shown to be positive by relation to the sign of the C^{13}-H coupling. Taking the H-P-C-H and the H-P-P-H couplings as positive and reasoning from this approach, the P^{31}-H coupling is positive. I.v.L.

N64-13280* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

CRITICALITY CALCULATIONS FOR A FAST LIQUID-METAL-COOLED REACTOR – PHASE I

H. G. Gronroos 15 Nov. 1963 27 p refs
(NASA Contract NAS7-100)
(NASA CR-53017; JPL-TR-32-512) OTS: $2.60 ph, $1.01 mf

Multigroup diffusion theory calculations have been employed to evaluate some static reactor physical properties for a conceptual fast liquid-metal-cooled reactor. Also, the influence of the constructional components on reactivity is investigated. It is concluded that the reactor concept holds promise in fulfilling the requirements of 20,000 hr of operation at 10 Mw thermal power with reflector control, provided 45,000 Mwday/ton burnup can be achieved with a uranium refractory and lithium fuel slurry at 2700° F peak fuel temperature. Author

N64-13290 Laboratoire de Physique Theorique et Des Hautes Energies, Orsay (France)

NOTE ON THE "BOOTSTRAP" EXPLANATION OF THE N AND N_{33}

B. Diu and H. R. Rubinstein Dec. 1963 7 p refs

As the relativistic calculations already performed in the π-N systems do not prove that the N and the N_{33} are simultaneously composite, the corresponding "bootstrap" equations are solved in the static model. The solution is found without need of computers, and is reasonable. Author

N64-13304 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.

INVESTIGATION OF FUNDAMENTAL MECHANISM OF DAMAGE TO THIN TARGETS BY HYPERVELOCITY PROJECTILES Semiannual Report

C. J. Maiden, J. W. Gehring and A. R. Mc Millan Mar. 1963 91 p refs
(Contract Nonr-3891(00)(X))
(DRL-TR63-208; AD-404274)

The objective of this program is a detailed study of the mechanisms of penetration, perforation, and spalling of a thin target caused by the impact of a hypervelocity projectile. Thin targets of various materials and thicknesses have been impacted with projectiles through a wide range of velocities. A physical model of the phenomenon of hypervelocity impact has been obtained and is presented, together with a comparison of the predicted and actual results. Author

N64-13306 Massachusetts U., Amherst Polymer Research Inst.

THE SCATTERING OF LIGHT FROM THIN POLYMER FILMS. 6 EXPERIMENTAL STUDIES ON BIAXIALLY ORIENTED POLYETHYLENE

T. Hotta and R. S. Stein 17 Oct. 1963 15 p refs
(Contract Nonr-3357(01))
(ONR-TR-59; AD-425603)

Experimental studies dealing with the scattering of light were conducted on thin, biaxially oriented polyethylene films. Equations for the polarized components of scattering are presented, and evaluation is given of scattering parameters. C.L.W.

N64-13309 Naval Radiological Defense Lab., San Francisco, Calif.

HEAVY MASS YIELDS IN THE SLOW NEUTRON FISSION OF U^{233}

L. R. Bunney and E. M. Scadden 12 Sep. 1963 19 p refs
(Contract AT(49-2)-1167)
(USNRDL-TR-679; AD-424445)

The chain yields of masses 157, 159, and 161 in the thermal neutron fission of U^{233} were determined by radiochemical methods. The last radioactive member of the mass chain was isolated and its activity measured relative to Mo^{99}. With this ratio and pertinent data from the thermal neutron fission of U^{235}, the mass chain yield was calculated. The chain yields are: mass-157 (15.4 hr–Eu^{157})—0.00635%, mass-159 (18.5 hr–Gd^{159})—0.000905%, and mass-161 (6.9 d–Tb^{161})—0.000117%. These yields are higher than was to be expected from analogy with the relative yields from thermal neutron fission of U^{235} and U^{238}. A possible explanation is given. The chain yields of masses 91, 141, 143, 144, 147, 149, 151, and 153 in the thermal neutron fission of U^{233} and U^{235} were also determined in the same manner. The values, when compared to the literature values for the chain yields, provided an estimate of the accuracy of the radiochemical measurement. The accuracy is estimated to be ±10%. Author

N64-13317 Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

COMMERCIAL FABRICATION OF PLUTONIUM FUEL

A. A. Johnson, J. E. Crawley, J. M. Hoffmann, R. T. Huntoon, and D. A. Orth Jun. 1963 111 p refs
(Contract AT(07-2)-1)
(DP-838) OTS: $2.25

This report evaluates the use of plutonium in power reactors and is intended to acquaint interested parties with the possibilities of the commercial fabrication of plutonium fuels and with the kind of fabrication facilities required. To treat these topics adequately, the supplies and markets for plutonium fuels are assessed, methods of making typical fuels are discussed, the health and safety requirements of a plutonium-handling facility are presented, and the resulting construction and operating costs are estimated. I.v.L.

N64-13324 European Organization for Nuclear Research, Geneva (Switzerland)

TRANSFORMER COILS FOR HIGH MAGNETIC FIELDS

L. Hoffmann and V. Scheuing 22 Oct. 1963 33 p refs
(CERN-63-36)

The principles of construction of transformer-type coils used to produce fields greater than 200 kgauss over a small volume are presented, and experimental results obtained on various models are discussed. Some theoretical considerations of the principle of the transformer coils are introduced, and approximate calculations are presented for use in interpreting the experimental results. Author

N64-13326* Martin Co., Baltimore, Md. RIAS Div.

FLUORESCENCE STUDIES

Bessel Kok Repr. from "Photosynthesis Mech. in Green Plants", Nat. Acad. Sci.–Nat. Res. Council, Publ., no. 1145, 1964 p 45–55 refs
(NASA Contract NASw-747)

An investigation was made of the fluorescence of a sample of chloroplasts which was kept in the dark for a few minutes and was then cooled to liquid nitrogen temperature, also in darkness. Upon addition of the exciting light, the fluorescence intensity was found to rise instantaneously to a certain

level (E_0) and from there on much more slowly until it reached a final value (E_{max}). Data were obtained on the emission spectra of chloroplasts (at 77° K) briefly treated with increasing concentrations of acetone in water, and on the fluorescence spectra of two types of *Scenedesmus* cells (at 300° K and at 77° K). The fluorescence emission of the red alga, TX27, excited either by green light or by blue light (at 300° K and 77° K) was investigated. Data are also included on measurements (made at room temperature) of fluorescence as a function of intensity, run concurrently with measurements of the rate of dye reduction by fresh chloroplasts. The data demonstrated that efficient electron transport corresponds to a low yield of fluorescence. R.T.K.

N64-13330 Midwestern Universities Research Assn., Madison, Wis.
A METHOD OF RADIO-FREQUENCY INFLECTION INTO A PARTICLE ACCELERATOR
Donald Scott Roiseland (Ph.D. Thesis–Wisconsin U.) 1963 226 p
(Contract AT(11-1)-384)
(MURA-674) OTS: $3.00

A radiofrequency method of inflecting particles (supplied from a given injector) into orbits suitable for subsequent acceleration in a cyclic particle accelerator is studied theoretically and experimentally. The particles circulating in the accelerator are subjected to an "RF bump"—a transverse radiofrequency electric field over a small length of the orbit, tuned to the frequency of the radial betatron oscillations. It is shown that, in the absence of nonlinear effects and with no septum (inactive injector extremity), the number of particles made available for acceleration can be as large as the limit set by Liouville's theorem (100% filling efficiency). In achieving this limit not less than 75% of the injected charge is wasted (25% charge efficiency). Nonlinear effects decrease both the charge and filling efficiencies. Author

N64-13341* National Bureau of Standards, Washington, D.C.
A LOW-PRESSURE ARC SOURCE FOR THE EMISSION SPECTRUM OF THE FeO MOLECULE
R. K. Dhumwad (AEC, Trombay, India) and Arnold M. Bass Reprint from Appl. Optics, v. 2, no. 12, Dec. 1963 p 1335
(NASA Order R-64)

The arc between iron electrodes operates at 0.6 amp dc, in flowing oxygen at a pressure of 7 cm Hg. The arc gap was 6.35 cm with a potential difference of 450 v. The appearance of the arc was flamelike and yellowish in color. Under these conditions of the source, the line spectrum of iron was found to be suppressed. The emission spectrum of the FeO molecule was obtained and was completely free of overlapping atomic iron lines. R.T.K.

N64-13348 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany) Inst. für Energiewandlung und Elektrische Antriebe
THEORETICAL AND EXPERIMENTAL RESEARCHES ON MAGNETIC TRIODES FOR ENERGY CONVERSION [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN AN MAGNETFELD-TRIODEN ALS ENERGIEWANDLER]
Karl Schuster Oct. 1963 48 p refs In GERMAN
(DVL-289)

Thermionic converters are becoming very important for the direct conversion of heat to electric energy. The magnetic field triode is one of the theoretically possible solutions. The limitation of the emitted current intensity by the electron space charge is overcome through strong electric fields. The magnetic field should prevent arrival of electrons at the high voltage electrode. The effect of the electron scattering in the even magnetic field triode is theoretically investigated, and the high losses observed in all experiments can thereby be explained. For the 90°-magnetic field triode with azimuthal variable magnetic field, proposed by J. E. Hatch, numerous electron paths have been calculated for field strengths which deviate from the theoretical value. As a result of the investigations, it can be said that the magnetic field triode is not appropriate for energy transformation; since the losses in them are inherently too large, the emitting cathode surface could be of only small size, and the technical realization of magnetic fields would in any case bring with it basic difficulties. Trans. by D.E.W.

N64-13354 Iowa State U. of Science and Tech., Ames
RADIOCHEMICAL STUDIES OF SOME PILE-NEUTRON FISSION YIELDS OF THORIUM-232
James M. Crook and A. F. Voigt Nov. 1962 94 p refs
(Contract W-7405-ENG-82)
(IS-558) OTS: $2.00

A more accurate, than previous, determination of the yields of some mass numbers in thorium fission by radiochemical methods was investigated. A four-pi beta proportional counter was used rather than a Geiger Müller counter. The metal foil thorium samples were irradiated with a neutron flux of the order of 10^{13} neutrons/sec^2/cm^2. The relative mass yields of mass numbers 89, 91, 99, 141, 143, 144, and 147 were determined by separating and counting strontium^{89}, yttrium^{91}, molybdenum^{99}, cerium^{141}, praseodymium^{143}, cerium^{144}, and neodymiun^{147}. The relative mass numbers 90 and 140 were determined by separating strontium^{90}, and barium^{140} and then milking and counting their daughters, yttrium^{90} and lanthanum^{140}. The mass numbers and their yields relative to mass number 140 were found to be: 89, 1.04 ±0.06; 90, 1.09 ±0.06; 91, 0.64 ±0.04; 99, 0.40 ±0.03; 140, 1.00; 141, 0.95 ±0.06; 144, 1.04 ±0.06; and 147, 0.39 ±0.03. The 91 mass was unaccountably low, but the others, including the yields of mass numbers 143 and 147, fit on the smooth yield curve of Turkevich and Niday. Author

N64-13364 Stanford U., Calif. Stanford Linear Accelerator Center
A BENDING MAGNET WITH NONSATURATING SHIMMING
B. Hedin Sep. 1963 35 p refs
(Contract AT(04-3)-400)
(SLAC-19) OTS: $0.75

A discussion and calculations are given concerning the design of shims added to the corners of magnets which have rectangular poles. By rounding off the corners of sharp-cornered magnets and reducing the gap, the homogeneous region of the field is enlarged. Through shimming and rounding the corners, homogeneity of the field is improved, and local saturation is avoided. Also field shape is obtained that is essentially independent of the field strength in the gap, up to a level where the poles start to saturate. C.L.W.

N64-13365 Stanford U., Calif. Stanford Linear Accelerator Center
EFFECTS OF STRAY MAGNETIC FIELDS AND RF COUPLER ASYMMETRY IN THE TWO-MILE ACCELERATOR WITH SECTOR FOCUSING
R. H. Helm Oct. 1963 26 p refs
(Contract AT(04-3)-400)
(SLAC-20) OTS: $0.50

Formulation is discussed and calculations are given in a study of the effects of stray magnetic fields and radiofrequency coupler asymmetries in a focused accelerator. Formulation

includes periodic focusing and the effects of stray magnetic fields. Typical calculations are given for the magnetic-field constant over the length of the machine and for the case where the stray magnetic field is essentially constant over the space between the lenses but has random uncorrelated variations from section to section. C.L.W.

N64-13367 Stanford U., Calif. Stanford Linear Accelerator Center
TWO-MILE ACCELERATOR PROJECT [Sixth] Quarterly Status Report, 1 Jul.-30 Sep. 1963
Oct. 1963 86 p refs
(Contract AT(04-3)-400)
(SLAC-23) OTS: $2.00

Detailed design of the klystron support is complete, and initial tests were carried out on the first, model. A less expensive and more easily fabricated focusing electrode has been designed for the gun. The preparation of a bid package for klystron-modulator procurement, the preparation of several design studies of trigger-system components, and the preparation of criteria for data handling for the central control have been accomplished. In addition, the current status of the following areas is presented: (1) plant engineering; (2) accelerator structure; (3) microwave engineering; (4) systems engineering and installations; (5) the Mark IV accelerator program; and (6) the research division. I.v.L.

N64-13369 Phillips Petroleum Co., Idaho Falls, Idaho
NON-DESTRUCTIVE AND DESTRUCTIVE TRANSIENT TESTS OF THE SPERT I-D, FULLY ENRICHED, ALUMINUM-PLATE-TYPE CORE: DATA SUMMARY REPORT
M. R. Zeissler Natl. Reactor Testing Station, 27 Nov. 1963 66 p refs
(Contract AT(10-1)-205)
(IDO-16886) OTS: $1.50

This report is a documentation of the experimental data from each test of the series performed in the SPERT I reactor with the type D, fully enriched, aluminum plate-type core. The series of tests consisted of step-wise insertions of excess reactivity under conditions of ambient temperature and atmospheric pressure. The data obtained from each test are presented in tabular form and as plots of the time behavior of reactor power, fuel plate surface temperature, and pressure. Composite figures, displaying the behavior with time, of fuel plate temperatures and pressures at various positions in the reactor are included. Correlated data figures displaying measured test data as functions of asymptotic reactor period are also included. Author

N64-13373* Alabama U., Research Inst., Huntsville
ELASTIC SCATTERING OF SLOW ELECTRONS FROM ALKALI ATOMS
W. R. Garrett and R. A. Mann [1963] 34 p refs Submitted for Publication
(NASA Grant NsG-381)
(NASA CR-55166) OTS: $3.60 ph, $1.22 mf

The elastic scattering cross sections for slow electrons incident on sodium and potassium are calculated using a model for the polarization potential which was earlier used for cesium. In all the alkalis studied, the low energy scattering cross sections show an extreme sensitivity to the exact shape of the polarization potential in the region where r is comparable to the atomic radius, indicating the necessity of having an accurate description of the polarization term in the total scattering interaction potential. An attempt is made to derive the polarization potential applicable to the low energy collision problem, and calculations are made for electron–cesium atom collisions. It is found that the derived polarization potential has general features similar to those of the model. The results are compared with the available experimental data. Author

N64-13380 Stanford U., Calif. Stanford Linear Accelerator Center
PION PHOTOPRODUCTION IN HYDROGEN AND BERYLLIUM
Martial Thiebaux Oct. 1963 49 p refs
(Contract AT(04-3)-400)
(SLAC-21) OTS: $1.25

Numerical evaluations of the Drell cross section for pion production are presented. Tables and graphs for determining pion production rates in hydrogen and beryllium are presented. The following corrections to the basic rates are discussed: (1) thick radiator corrections; (2) nucleon recoil effect; and (3) the effect of nuclear Fermi motion. R.T.K.

N64-13381 Mound Lab., Miamisburg, Ohio
POLONIUM
7 Jan. 1964 66 p refs Transl. into ENGLISH from the book "Nouveau Traite de Chimie Minerale", v. 13, pt. 1, Paris, 1961 p 2041–2122
(Contract AT(33-1)-GEN-53)
(MLM-1165(Tr)) OTS: $1.50

The isotopes and nuclear properties of polonium are discussed. The methods for the nuclear production of artifical polonium isotopes are listed, and the procedures for extraction and chemical purification of polonium-210 from its various origins are described. The physical and chemical properties of the element are reviewed, and the inorganic and organic compounds of the polonium are discussed. C.L.W.

N64-13389 Union Carbide Nuclear Co., Oak Ridge, Tenn.
SCATTERING OF MOLECULES FROM SURFACES: THE EFFECT OF APPARATUS MISALIGNMENT ON THE DIRECTION AND INTENSITY OF INCIDENT AND SCATTERED MOLECULES
J. C. Crews 14 Jan. 1964 21 p refs
(Contract W-7405-eng-26)
(K-1584) OTS: $0.50

Matrix and vector methods have been used to develop a technique for computing the effect of misalignment on the direction of incident and scattered beams, and on the measured intensity of scattering from a surface. The analysis developed has been used in an IBM-7090 data reduction program. Author

N64-13393 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
STUDY OF THE PHENOMENA OF HYPERVELOCITY IMPACT Summary Report
D. R. Christman, J. W. Gehring, C. J. Maiden, and A. B. Wenzel Jun. 1963 152 p refs
(NASA Contract NAS8-5067)
(NASA CR-55266; TR63-216) OTS: $11.50 ph, $4.76 mf

This report is a critical investigation of the meteoroid hazard and of theoretical, empirical, and experimental investigations of hypervelocity impact. Simple and complex models of cratering and perforation are considered, as are the limitations and requirements imposed by practical engineering considerations. Results presented are based on a detailed review of the published works and on a number of independent experimental and theoretical research programs. Author

N64-13396 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro
ANGULAR DISTRIBUTION OF PHOTOFISSION FRAGMENTS FROM THORIUM
M. V. Ballariny 1963 14 p refs
(*Its* Notas de Fisica, Vol. 10, no. 12)

The angular distribution of photofission fragments of thorium, relative to an incident photon beam, was measured using bremsstrahlung (of a 24-Mev betatron at a maximum energy of 12.4 Mev) which were incident on ThO_2 films on nuclear emulsions. An anisotropic distribution of the form $W(\theta) = a + b \cdot sen^2\theta$ was found that corresponds to an electric dipole photon absorption. The ratio b/a of the anisotropic dipole fission yield to the isotropic yield was found to be 0.73 ±0.15. Author

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see:* 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-12574 Comitato Nazionale Per l'Energia Nucleare, Rome (Italy) Lab. Gas Ionizzati
ON THE VARIATIONAL PRINCIPLE ENERGY THROUGH HYDROMAGNETIC SYSTEM [SUL PRINCIPIO VARIAZIONALE DELL'ENERGIA PER I SISTEMI IDROMAGNETICI]
Livio Gratton CNEN, Div. Affari Intern. e Studi Econ., Uffic. Pubbl., Sep. 1962 21 p refs In ITALIAN
(RTI/F1(62)6)
(Osservatorio Astronomico di Roma, Contrib. Sci., Ser. 3, no. 16)

The variational principle of Hamilton for a hydromagnetic system formed by a perfect fluid of infinite conductivity and immersed in a magnetic field is reviewed. Canonical equations-of-motion around a configuration in equilibrium, normal modes of oscillation of the fluid, orthogonality of the eigenfunctions, and the stability of the configuration are discussed. Trans. by P.F.E.

N64-12580 Aerospace Corp., El Segundo, Calif. Labs. Div.
SURFACE IMPEDANCE OF A THIN PLASMA SHEET
T. M. Smith and K. E. Golden 7 Oct. 1963 55 p refs
(Contract AF 04(695)-269)
(TDR-269(4280-10)-1; SSD-TDR-63-261; AD-425654)

An analysis is made of electromagnetic propagation through a homogeneous, isotropic, and slightly ionized plasma slab. Exact solutions for the reflection and transmission coefficients are given as functions of slab thickness, incident angle, and plasma wave number. Two approximations are introduced which allow the plasma slab to become a thin current sheet. When the approximations are valid, the reflection and transmission coefficients for the thin plasma are a function of the sheet surface impedance only. This surface impedance is related simply to the product of the sheet thickness and conductivity. Author

N64-12595 Ohio State U. Research Foundation, Columbus
SPECTROGRAPHIC ANALYSIS OF PLASMA FLOWS
E. S. Fishburne and S. L. Petric Wright-Patterson AFB, Ohio, Res. and Tech. Div., Sep. 1963 89 p refs
(Contract AF 33(657)-7561)
(ASD-TDR-63-98; AD-423323)

Both experimental and theoretical studies are reported that relate to the spectrographic determination of the temperature and species concentration distributions across the nozzle exit of an arc-heated wind tunnel. A detailed review of the basic theory of spectral line intensities is presented, and the various spectrographic techniques for the determination of gas temperatures and species concentrations are given. The performance characteristics of the arc tunnel operating with argon are summarized, and the effects of various configuration modifications on the basic performance are described. Spectrographic analyses of the exhaust jet are reported. The results indicate that some degree of nonequilibrium electronic excitation was present at the nozzle exit. The gas temperatures obtained from rotational spectra agree reasonably well with theoretical predictions. Author

N64-12599 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
IONIZATION NONEQUILIBRIUM EFFECTS ON MAGNETOGASDYNAMIC INTERACTION IN THE STAGNATION REGION OF AN AXISYMMETRIC BLUNT BODY Technical Documentary Report [1 Mar. 1961-Oct. 1962]
Donald W. Boyer Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Sep. 1963 104 p refs
(Contract AF 33(616)-8055)
(ASD-TDR-62-1078; AD-422080)

Exact numerical calculations have been made of the effects of finite rate chemical and ionization processes in hypersonic nozzle and axisymmetric blunt body flows pertinent to experimental magnetogasdynamic studies. The results have shown that the electrical properties of the nonequilibrium airflows are inadequate for the attainment of observable MGD effects unless very high magnetic field strengths are used. Numerical calculations of the effects of seeding such flows have shown that small amounts of seed material, insufficient to influence the gasdynamic and chemical properties of the flow, may result in the attainment of magnetic interaction parameters of significance for the performance of MGD experiments in hypervelocity facilities. Numerical solutions of the axisymmetric nonequilibrium MGD-shock-layer interaction are described. The results demonstrate a significant magnetic effect in seeded airflows for moderate (2500 gauss) field strengths. The solutions indicate that both the shock standoff distance and radius of curvature increase with the strength of the interaction. The pressure distribution around the body was found to increase above the Newtonian result with increase of field strength. Author

N64-12606 Ohio State U. Research Foundation, Columbus Antenna Lab.
CALCULATION OF THE ECHO AREA OF AN n-LAYER PLASMA CYLINDER AND SPHERE
Tadasu Kawano and Leon Peters, Jr. May 1963 25 p refs
(Contract AF 19(604)-7270)
(Rept. 1116-33; AFCRL-63-387; AD-423019)

The echo areas of inhomogeneous plasma bodies are treated by the application of the modified geometrical-optics method. The formulas for the echo area of an n-layer plasma cylinder have been deduced from those for the echo areas of three plasma cylinders of a simpler nature. Equations for the scattered fields due to the specular rays from the ith layer of an n-layer body are given. The total field scattered by this multilayered body is simply the phasor sum of the components above. Author

N64-12615 Aerospace Corp., El Segundo, Calif.
HEATING AND CONFINEMENT OF A PLASMA BY ALTERNATING MAGNETIC FIELDS

Erich S. Weibel 20 Nov. 1963 41 p refs
(Contract AF 04(695)-169)
(SSD-TDR-63-312; TDR-169(3210-05)TN-3; AD-425559)

A method is proposed in which a plasma is confined by an alternating magnetic field. The plasma is field-free except in a thin boundary layer. No diffusion takes place since this boundary is periodically reconstituted by the field, maintaining the penetration depth at the fixed value c/ω_p. At high temperatures, the confining field heats both electrons and ions, preferentially the latter. This heating is very efficient. About half of the total applied power is absorbed by the plasma, the rest being copper losses. The technical feasibility of plasma confinement by alternating magnetic fields is examined, and numerical examples are given. Author

N64-12657 Aerospace Corp., El Segundo, Calif.
EFFECTS OF COLLISIONS ON ELECTRON DENSITY FLUCTUATIONS IN PLASMAS
M. S. Grewal 22 Oct. 1963 41 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-265; TDR-269(4280-30)-1; AD-425596)

The spectrum of electron density fluctuations has previously been calculated for a collisionless plasma. In this paper the theory is extended to include collisions as represented by a Fokker–Planck equation such as the one used in the theory of Brownian motion. Numerical calculations have been carried out to show graphically the transition of the spectrum from the collisionless to the collision-dominated case. The results of the present analysis involve some thus far untabulated functions. These functions have been numerically evaluated, and the results are presented in graphical form. Author

N64-12684 Maryland U., College Park
CRITICAL SURVEY OF MAGNETOFLUID DYNAMICS. PART I: GENERAL DISCUSSION [Report Period, Feb. 1962–Mar. 1963]
Shih I. Pai Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Oct. 1963 85 p refs
(Contract AF 33(657)-7805)
(ARL-63-175, Pt. 1; AD-423893)

This report gives a critical survey of magnetohydrodynamics with special emphasis on the fundamental features of this branch of fluid dynamics and the new phenomena which differ from those of ordinary fluid dynamics. After some discussions of the fundamental equations of magnetohydrodynamics and their properties, several typical flow problems of magnetohydrodynamics are analyzed which include one dimensional flow, MHD power generation, inviscid flows, and viscous flows. Author

N64-12717* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF A CONSTRICTED-ARC SUPERSONIC JET
Charles E. Shepard, Velvin R. Watson, and Howard A. Stine Washington, NASA, Jan. 1964 38 p refs
(NASA TN D-2066) OTS: $1.00

A constricted-arc supersonic jet has been constructed and tested. An electric arc originates in the plenum chamber and is passed completely through the supersonic nozzle into the test section. The arc is maintained through the nozzle without disrupting the supersonic flow. High total enthalpies are produced by forcing the gas to flow through the arc column within an elongated, well-cooled throat that acts to thermally constrict the discharge. Average total enthalpies were determined by means of a balance between the electrical power supplied to the gas stream and the power losses to the various water-cooled components. Average enthalpies in excess of 30,000 Btu/lb were measured in the gas at the downstream end of the constrictor tube. Laminar conduction was the predominant heat loss mechanism from the gas to the water-cooled constrictor walls. Author

N64-12843 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ATMOSPHERIC CURRENTS AT ALTITUDES OF 80-100 KM BY OBSERVING THE DRIFTS OF METEORIC TRACES
A. P. Savrukhin 9 Oct. 1963 6 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 10, 1962 p 34–36
(FTD-TT-63-845/1+2; AD-424480)

Observations of the drifts of meteoric traces were made by the visual–optical method from 1950 through 1956 at Askhabad. The observations were conducted annually between August 5 and August 15, and for that reason the results obtained characterize the kinematic strata of the upper atmosphere in the region of the observation point for the summer season of the year. During this entire period, 58 stable ionization tracks of meteors with a luminosity duration of from 10 to 390 seconds were observed. Results are as follows: (1) The drift velocity distribution in the altitude range 84 to 101 km was obtained. (2) The wind velocity decreased with altitude. The mean vertical velocity gradient was −1, −2 m/sec/km. The presence of a definite zone of altitudes (approximately 88 to 95 km) with a thickness of 4 to 7 km and with maximum drift velocities was revealed. In the lower part of such a zone, the gradient was positive, and in the upper part it was negative, with maximum values of from +12 to −12 m/sec/km. (3) Drifts toward the northeast, east, southeast, and south were observed prior to and after local midnight. Drifts toward the northwest were observed only after local midnight. I.v.L.

N64-12856 Columbia U., New York, N.Y. School of Engineering and Applied Science
PARAMETER SPACE MAPPING OF GUIDED ELECTROMAGNETIC WAVES OF A MAGNETO-PLASMA COLUMN Scientific Report No. 79
V. L. Granatstein and S. P. Schlesinger 20 Sep. 1963 129 p refs
(Contract AF 19(628)-2461)
(AFCRL-63-398; CU-3-63-AF-2461-EE; AD-425544)

Modes of guided high-frequency electromagnetic propagation along an air bounded, axially magnetized plasma column of finite radius, a, are studied through the technique of parameter space mapping. The parameter space is three-dimensional with ω ordinates given by normalized plasma frequency, ω_p/ω, normalized cyclotron frequency, ω_b/ω, and a third normalized frequency corresponding to column size, $c/\omega a$. In this three-dimensional space, cutoff and resonance loci are surfaces, and the volumes they enclose correspond approximately to domains of existence for various classes of waves. Three classes of guided wave can exist on a magnetoplasmaguide and were found to be characterized by distinctive cutoff and resonance surfaces. The wave classes have been designated as: (1) static, low frequency waves, in the regime $\omega < \omega_p$ and $\omega < \omega_b$; (2) dynamic, high-frequency waves constrained by $\omega > \omega_p$; and (3) surface wave, characterized by concentration of field energy at the plasma–air interface. A semiquantitative method has been developed for sketching dispersion curves from parameter space information combined with analysis at frequencies adjacent to resonance and cutoff. Author

N64-12947* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ARC DISCHARGE IN A PARALLEL FLOW OF ARGON
Hiroshi Sato 31 Oct. 1963 23 p refs
(NASA Contract NAS7-100)
(NASA CR-50818; JPL-TR-32-520) OTS: $2.60 ph, $0.89 mf

A dc arc discharge was made in a parallel subsonic flow of argon with a discharge current of about 70 amp and a flow velocity as large as 27 m/sec at a pressure of 300 torr and as large as 70 m/sec at 100 torr. The flow stabilizes the arc, and when the discharge current is kept constant, the observed diameter of the arc decreases and the voltage drop across electrodes increases as the flow speed is increased. Detailed experimental results indicate that the electric field intensity in the positive column increases almost linearly with the flow speed. A spectroscopic measurement shows a temperature rise near the arc axis as an effect of the flow. Measurements of the time-mean velocity as well as the fluctuation were made by use of a hot-wire anemometer. Physical properties of an argon plasma were calculated, assuming thermal equilibrium. The heat balance of a long cylindrical plasma with radial gas flow was treated theoretically. The solution of the energy equation shows a fair agreement with the experimental results for the field intensity and temperature distributions.
Author

N64-13003 Nihon U., Tokyo (Japan) Coll. of Science and Engineering
NUMERICAL ANALYSIS OF NON-LINEAR EFFECTS IN THE PHENOMENA OF RESONANCE PROBE
Yoshi H. Ichikawa [1963] 12 p
(NUP-63-15)

A numerical analysis was made of the effects of the nonlinear response of electron distribution in the resonance probe, taking into account the transit time effect. A semiphenomenological theory, which provides a basic understanding of the characteristics of the resonance probe, was formulated. This theory explains consistently every aspect of Cairns' experimental result except the effect of the bias potential V for the resonance peak. The effect of nonlinear response becomes very essential for large values of ω_p/v. Hence one can expect to observe the effect of the nonlinear response for highly ionized plasmas such as cesium plasma.
I.v.L.

N64-13020 Princeton U., N.J. Plasma Physics Lab.
UNIVERSAL INSTABILITY IN A FULLY IONIZED INHOMOGENEOUS PLASMA
Herbert Lashinsky Dec. 1963 10p refs
(Contract AT(30-1)-1238)
(MATT-234)

The results are presented of experiments in which it was found possible to examine low-frequency oscillations, of a fully ionized inhomogenous cylindrical plasma column in a magnetic field, which were identified as normal modes of the universal instability. These experiments were carried out in a Q-device, in which a quiescent plasma column about 100-cm long and 3 cm in diameter was produced by thermal ionization of atomic cesium on hot tungsten plates. The experimental results are felt to represent qualitative verification of the theoretical analyses of the universal instability where appropriate analysis was available.
R.T.K.

N64-13027 Nagoya U., (Japan) Inst. of Plasma Physics
MICROWAVE RADIATION FROM A PLASMA IN A MAGNETIC FIELD
Shigetoshi Tanaka, Kenji Mitani, and Hiroshi Kubo (Kyoto U.) Jul. 1963 36 p refs Previously reported in Japan. in Kakuyugo-Kenkyu, v. 9, 1962
(IPPJ-13)

The microwave radiations from a dc discharge plasma in a magnetic field were studied. The experimental results showed that the resonant radiations of the extraordinary wave, propagating perpendicular to a magnetic field, were observed not only at $\omega = (\omega_p^2 + \omega_b^2)^{1/2}$, but also near the cyclotron harmonics. On the other hand, it was shown that the dispersion relation for the plasma-type oscillations derived by Bernstein had a harmonic structure; in the experiment their dispersion curve was divided into many branches, each of which approached asymptotically the curves given by $\omega^2 = \omega_p^2 + \omega_b^2$ and by $\omega = n\omega_b$ (n being an integer). The resonant radiation detected was interpreted as the plasma-type radiation mentioned previously. The gaps in the radiation spectrum at the cyclotron harmonics were not measured in the discharge plasmas. Further, the number of successive harmonics in the radiation increased with a decrease in the gas pressure, independently of the kind of gas used.
Author

N64-13056* Maryland U., College Park Inst. for Fluid Dynamics and Applied Math.
ON THE "TEST PARTICLE" PROBLEM FOR AN ELECTRON PLASMA
D. A. Tidman and David Montgomery Dec. 1963 9 p refs Submitted for Publication
(NASA Grant NsG-220-62)
(NASA CR-55147; BN-342) OTS: $1.10 ph, $0.80 mf

Fokker–Planck coefficients for a test particle distribution in an equilibrium electron plasma are calculated from the generalized Balescu–Lenard equation. The results are found to disagree slightly from those of Rostoker and Rosenbluth.
Author

N64-13073 Illinois U., Urbana Gaseous Electronics Lab.
STUDIES IN ELECTROMAGNETIC WAVE INTERACTION TECHNIQUES Final Report
K. V. Narasinga Rao and L. Goldstein Oct. 1963 29 p refs
(Contract AF 19(604)-3481)
(AFCRL-63-737; AD-426186) OTS: $2.60

The technique of interaction of guided electromagnetic waves in magnetoplasmas is utilized to study the phenomena resulting from the cyclotron resonance ($f = f_H$ = gyrofrequency of electrons) absorption of microwave energy by the electron gas. The enhancement in electronic energy caused by this absorption is experimentally evidenced by the study of (1) gyrointeraction of microwaves of different frequencies ($f_1 \leq f_H \leq f_2$), (2) emission of microwave noise power at frequencies $f_n \geq f_H$, (3) intensity of visible light excitation, and (4) rapid disintegration of the plasma. A correlation of these experimental results shows that (1) the rate of heating of any specific region of the plasma changes drastically during different time intervals of the pulsed resonant heating microwave signal, and (2) nonuniform heating occurs along the plasma axis.
Author

N64-13105 United Aircraft Corp., East Hartford, Conn. Research Labs.
THE EFFECTS OF BODY FORCE AND FINITE ELECTRICAL CONDUCTIVITY ON THE HYDROMAGNETIC STABILITY OF A DISCONTINUOUS SHEAR FLOW Final Report, Jan. 1962–Oct. 1963
F. O. Carta Edwards AFB, Calif., Research and Tech. Div. Nov. 1963 51 p refs
(Contract AF 04(611)-8189)
(RTD-TDR-63-1100; AD-424812)

A theoretical investigation was conducted to determine the effect of a collinear magnetic field on the conditions which lead to Kelvin–Helmholtz instabilities in an incompressible, inviscid fluid having finite electrical conductivity and a step discontinuity in both velocity and density across a plane interface. A closed-form solution was obtained which relates stability boundaries to Froude number, Alfvén number, and magnetic Reynolds number, and this solution was evaluated for selected values of these quantities. Under appropriate limiting conditions, the results of the present study agree with solutions which are available for a nonconducting fluid and for a perfectly conducting fluid. Author

N64-13154 Princeton U., N. J. Plasma Physics Lab.
LOW-FREQUENCY INSTABILITIES OF A FULLY IONIZED GAS
Francis F. Chen Sep. 1963 17 p refs
(Contract AT(30-1)-1238)
(MATT-214)

Low-frequency fluctuations (plasma instabilities) are found in fully ionized gases suffering from anomalous diffusion, such as in a stellerator, where a radial electric field is always observed. This report discusses an investigation into the cause of these instabilities, the results of which are summarized as follows: It was found that the centrifugal force on a rotating plasma can cause such instabilities. A radial electric field can be expected to arise in a torodial discharge in which $KT_e >> KT_i$, and the plasma is defined by an aperture limiter. Such fields are normally opposite in sign from those needed for the reflex-discharge instability. Local shear fields can also arise in the interior of the plasma due to charge separations caused by magnetic field inhomogeneities; in such a case, the ion viscosity can lead to an instability. The effects noted above can be eliminated by stopping the rotation of the plasma or by imposing a periodicity in the z-direction. I.V.L.

N64-13155 Princeton U., N.J. Plasma Physics Lab.
A CRITERION FOR STABILITY AGAINST RESISTIVE INTERCHANGE MODES
Bruno Coppi 19 Aug. 1963 7 p refs
(Contract AT(30-1)-1238)
(MATT-220)

It has been found, when considering the effect of a small resistivity on the stability of hydromagnetic systems, that the fastest growth rates of the new modes are proportional to the cube root of the resistivity. In particular, when the analysis is applied to very low β systems it appears that, if a gravitational field or a negative pressure gradient along the radius of curvature is present, unstable interchange resistive modes may exist. The same conclusion holds when incompressibility is assumed. This report shows that if $\beta \equiv 2p/B^2$ is of the same order of magnitude as $2p'R/B^2$ and small, but not negligible, a criterion for stability against localized interchange modes can be given. The case of a cylindrical pinch configuration is referred to where R is the radius, p the pressure, p' the pressure gradient, and B the magnetic field in the equilibrium. The condition is

$$-p'R/p < H + F^2/H + O(\beta), \qquad (1)$$

where $F \equiv Rr(B_z/B)^2\ d/dr\ [B_\theta/(rB_z)]$ represents the shear of the equilibrium magnetic field, B_θ and B_z its azimuthal and axial components, r the radial coordinate and $H \equiv 2R(B_\theta/B)^2/r$. When $-Rp'\beta/(2p)$ is finite, Eq. (1) reduces to $Rp'p < 0$ as previously found. In the absence of dissipation, the corresponding criterion for hydromagnetic interchange modes has been found to be $-p'R/p < F2/(2\beta H)$. I.v.L.

N64-13215 California U., Berkeley. Lawrence Radiation Lab.
A STUDY OF HYDROMAGNETIC WAVE PROPAGATION IN PLASMA
George R. Spillman (Thesis) 2 Oct. 1963 98 p refs
(Contract W-7405-eng-48)
(UCRL-10990) OTS: $2.25

An investigation of the excitation of torsional and compressional hydromagnetic waves, and of the dispersion relation of the torsional wave in a cylindrical deuterium plasma is reported. The theory of azimuthally symmetric waves in a cylinder is reviewed, and an expression is derived for the relative excitation of the two wave types by a current between concentric electrodes. The wave type propagating in the cylinder at various frequencies is established by simultaneous measurements of the r and θ components of the wave magnetic field, and the dispersion relation of the torsional wave is measured in the frequency range of 0.04 to 0.48 times ion-cyclotron frequency. (The upper frequency limit is due to domination of the compressional wave at higher frequencies.) Author

N64-13295 Nagoya U. (Japan) Institute of Plasma Physics
RESONANCE PROBE Research Report
H. Ikegami and K. Takayama Mar. 1963 32 p refs
(IPPJ-10)

The resonance probe method is a new technique developed by the authors to determine instantaneously the density, temperature, and effective collision of electrons. The frequency of a low-voltage RF signal superposed on a probe is swept within adequate frequency range, and the dc component of the electron current, due to the nonlinearity of the sheath impedance, is measured. The resonant increase appears in the current at the electron plasma frequency. The characteristic curve of the resonance probe consists of the following three frequency ranges: the first lower frequency range where the electron current keeps a constant value independent of the frequency; the second range where a resonance peak appears; and the third higher frequency range where the superposed RF signal causes no dc current increase. I.v.L.

N64-13400* Pennsylvania U., Philadelphia Inst. for Direct Energy Conversion
THE OPTIMIZATION OF MHD GENERATORS WITH ARBITRARY CONDUCTIVITY
Hsuan Yeh and Tsu-Kai Chu [1963] 39 p refs Presented at the ASME Winter Ann. Meeting, Philadelphia, Nov. 1963
(NASA Grant Nsg-316)
(NASA CR-55183) OTS: $3.60 ph, $1.37 mf

Two series of calculations were performed. In the first series, the conductivity was assumed to vary with T^ω. Quick convergence to an optimum distribution was obtained with $\omega = 10$ for all inlet Mach numbers used except $M_0^2 = 2$. The optimum powers extracted were then compared for various inlet Mach numbers, both for constant inlet temperature and for constant inlet stagnation temperature. In the second series, conductivity was assumed to vary with $T^{10}/\sqrt{p}$. It was found that the power extracted keeps increasing as exit pressure decreases, and no maximum power exits for finite exit area. With practical limits for exit-to-inlet area ratios of 10 and 20, the optimum extracted power was then obtained for various inlet Mach numbers. As expected, the improvement over the constant velocity distribution was great. Author

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-12447 Joint Publications Research Service, Washington, D.C.
PRODUCTION AND PROPERTIES OF SINGLE CRYSTALS OF THE REFRACTORY METALS TUNGSTEN, RHENIUM, TANTALUM, MOLYBDENUM, AND NIOBIUM
Ye. M. Savitskiy, Ch. V. Kopetskiy, A. I. Pekarev, and M. I. Novosadov *In its* Studies in Casting, Production, and Refining of High-Temp. Alloys 18 Dec. 1963 p 6–9 (See N64-12445 04-01) OTS: $1.00

A laboratory setup for the zone purification of refractory metals and the production of single crystals using electron-beam melting is described in detail. The Vickers hardness, measured on the cross sections of the single crystals obtained using this apparatus, had the following values in kg/cm^2: Mo—170; Nb—79; Ta—75; Re—154; and W—345. Single crystals of molybdenum, niobium, and tantalum showed a transverse constriction of about 100% in tensile tests. M.P.G.

N64-12559 Radio Corp. of America, Camden, N.J. Defense Electronic Products
LASERS
H. R. Lewis et al [1963] 31 p refs

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1. THE LASER—AN INTRODUCTION H. R. Lewis (RCA, Princeton) p 2–3 refs (See N64-12560 04-25)
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3. DEVELOPMENT OF EFFECTIVE LASERS L. A. Murray, M. F. Lamorte, and F. L. Vogel (RCA, Somerville) p 8–11 (See N64-12562 04-25)
4. MODULATORS AND DEMODULATORS FOR LASER SYSTEMS D. J. Blattner and F. Sterzer (RCA, Princeton) p 12–15 refs (See N64-12563 04-25)
5. LASERS FOR RANGING APPLICATIONS E. Kornstein (RCA, Burlington) p 16–19 refs (See N64-12564 04-25)
6. LASER CHARACTERISTICS AND SOME POTENTIAL APPLICATIONS D. Karlsons and D. J. Parker (RCA, Camden) p 20–22 ref (See N64-12565 04-25)
7. MASERS IN SYSTEM APPLICATIONS L. C. Morris (RCA, Camden) p 23–26 refs (See N64-12566 04-25)
8. SUN-PUMPED CONTINUOUS LASER R. C. Duncan, Jr., Z. J. Kiss, and H. R. Lewis (RCA, Princeton) p 27 refs (See N64-12567 04-25)
9. WIDEBAND MICROWAVE PHOTOTUBES FOR LASER COMMUNICATION SYSTEMS D. J. Blattner, H. C. Johnson, F. Sterzer, and J. E. Reudy (RCA, Princeton) p 27–28 refs (See N64-12568 04-25)
10. A NEW GaAs LASER THAT CAN BE PUMPED ELECTRICALLY J. I. Pankove (RCA, Princeton) p 28 (See N64-12569 04-25)

N64-12560 Radio Corp. of America, Princeton, N.J.
THE LASER - AN INTRODUCTION
H. R. Lewis *In* RCA, Camden, N.J. Lasers [1963] p 2–3 refs (See N64-12559 04-25)

A brief insight into the novel properties of the laser is provided. The significance of the coherence of laser radiation is discussed, and the working principles of the laser are explained. C.L.W.

N64-12561 Radio Corp. of America, Princeton, N.J.
RESEARCH ON LASER MATERIALS
P. G. Herkart, M. Kestigian, and P. N. Yocom *In* RCA, Camden, N.J. Lasers [1963] p 4–7 refs (See N64-12559 04-25)
(Contract AF 33(616)8199)

The importance of the proper choice of materials for laser operation was emphasized because continuous operation, heat dissipation, and operating frequency are all functions of this parameter. Several criteria are given which laser materials must fulfill, and the steps involved in the preparation of laser materials are discussed. Some of the materials utilized in lasers are given, and other materials which have possible use are mentioned. C.L.W.

N64-12562 Radio Corp. of America, Somerville, N.J.
DEVELOPMENT OF EFFECTIVE LASERS
L. A. Murray, M. F. Lamorte, and F. L. Vogel *In* RCA, Camden, N.J. Lasers [1963] p 8–11 (See N64-12559 04-25)

Effort has been devoted toward minimizing strain and impurities in grown laser crystals. Described are the effects on laser performance of the polish, parallelism, and reflecting surfaces of the prepared laser rod and the geometry of the pumping system, as well as the construction of absolute and relative threshold measurement apparatus. Author

N64-12563 Radio Corp. of America, Princeton, N.J.
MODULATORS AND DEMODULATORS FOR LASER SYSTEMS
D. J. Blattner and F. Sterzer *In* RCA, Camden, N.J. Lasers [1963] p 12–15 refs (See N64-12559 04-25)
(Contracts AF 33(616)-8199 and DA 36-039-SC-90846)

Wideband laser modulators that utilize crystals exhibiting linear electro-optic effects are under investigation, and work is being conducted on special microwave phototubes capable of demodulating light that has been modulated at gigacycle rates. Some of the techniques and some of the materials utilized in the systems are given. C.L.W.

N64-12564 Radio Corp. of America, Burlington, Mass. Aerospace Communications and Controls Div.
LASERS FOR RANGING APPLICATIONS
E. Kornstein *In* RCA, Camden, N.J. Lasers [1963] p 16–19 refs (See N64-12559 04-25)

A prototype laser ranging system is discussed along with the basic considerations of laser ranging. The prototype unit, as packaged includes a sighting telescope, transmitter, and receiver optics. A review is given of early ranging systems, and the generation of single pulses is discussed. A technique for controlling laser output is also given, along with the range equation developed for laser ranging systems. C.L.W.

N64-12565 Radio Corp. of America, Camden, N.J. Defense Electronic Products
LASER CHARACTERISTICS AND SOME POTENTIAL APPLICATIONS
Dainis Karlsons and Donald J. Parker *In its* Lasers [1963] p 20–22 ref (See N64-12559 04-25)

Favorable and unfavorable laser characteristics that affect applications, current trends and needs in laser equipment development, and potential laser applications are discussed. The ability to realize very small angular beamwidths in the optical region is the prime parameter of almost every application proposed for the laser, giving it the property of extremely efficient power transfer over long ranges. Small wavelengths associated with lasers mean that small oscillating structures

can serve as relatively high-gain antennas for radiating their energy. High noise temperatures, very difficult propagation characteristics for application through the earth's atmosphere, and rather poor efficiencies are all disadvantages of the laser. Some of the applications of the laser are as amplifiers; as a power generator capable of very-high-peak outputs; as well as average power levels; as detectors; in communication systems; and in radar systems. C.L.W.

N64-12566 Radio Corp. of America, Camden, N.J. Defense Electronic Products
MASERS IN SYSTEM APPLICATIONS
L. C. Morris *In its* Lasers [1963] p 23–26 refs (See N64-12559 04-25)

Attention was directed toward recent advances in maser development. This included the development of a traveling-wave maser; the construction of a small, compact maser utilizing rutile; the development of millimeter-wave masers; maser amplification at liquid-neon temperatures; and the application of masers in communications, such as in Telstar and Echo. The discussion also included maser noise temperature; antenna noise temperature; environmental noise sources; maser cooling systems; and future maser development. C.L.W.

N64-12567 Radio Corp. of America, Princeton, N.J.
SUN-PUMPED CONTINUOUS LASER
R. C. Duncan, Jr., Z. J. Kiss, and H. R. Lewis *In* RCA, Camden, N.J. Lasers [1963] p 27 refs (See N64-12559 04-25)
(Contract AF 33(616)-8199)

Laser action has been achieved in a $CaF_2:Dy^{2+}$ system at liquid-neon temperature (27° K) using the sun as the pumping source. This laser action in the $CaF:Dy^{2+}$ system was reported at 2.36 microns. The low pulsed laser threshold, the long lifetime, and the convenient location of the broad pumping bands of this system make it especially suitable for sun-pumped operation. C.L.W.

N64-12568 Radio Corp. of America, Princeton, N.J.
WIDEBAND MICROWAVE PHOTOTUBES FOR LASER COMMUNICATIONS SYSTEMS
D. J. Blattner, H. C. Johnson, F. Sterzer, and J. E. Reudy *In* RCA, Camden, N.J. Lasers [1963] p 27–28 refs (See N64-12559 04-25)
(Contract DA 36-039-SC-90846)

The RCA developmental A-1283 microwave phototube is schematically diagramed, and its operation is described. The light to be modulated passes through the optical window onto a transmission type photocathode. The photoelectrons emitted by the cathode are bunched at the modulation frequency of the light. As these electrons pass through a traveling-wave-tube type helix, they excite a traveling wave that is taken out at the output coupler. The tube with its focusing periodic permanent magnets is 18 inches long and weighs 5 pounds. C.L.W.

N64-12569 Radio Corp. of America, Princeton, N.J.
A NEW GaAs LASER THAT CAN BE PUMPED ELECTRICALLY
J. I. Pankove *In* RCA, Camden, N.J. Lasers [1963] p 28 (See N64-12559 04-25)

A very simple, electrically pumped, semiconductor laser was developed, that is comprised of a p-n junction diode in a wafer of gallium arsenide. The gallium arsenide was converted into a laser by altering its shape, by decreasing the contact resistance to reduce losses, and by increasing the current density through the junction. C.L.W.

N64-12587 General Electric, Co., Syracuse, N.Y.
SEMICONDUCTOR LASER AMPLIFIER TECHNIQUES (SEMLAM)
Fred J. Demma Griffiss AFB, N.Y. Techniques Lab. Nov. 1963 24 p refs
(Contract AF 30(602)-3111)
(RADC-TDR-63-429; AD-425350)

This report describes the planning and use of the semiconductor laser diodes as light amplifier, and an oxygen gas laser as a source. Author

N64-12590 Clevite Corp., Palo Alto, Calif. Shockley Lab.
FAILURE MECHANISMS IN SILICON SEMICONDUCTORS
H. Queisser, R. Scarlett, W. Schroen, and W. Hooper Griffiss AFB, N.Y. Applied Research Lab. Nov. 1963 50 p refs
(Contract AF 30(602)-3016)
(RADC-TDR-63-443; AD-425472)

The report covers investigations of two failure mechanisms: (1) second breakdown in silicon power transistors, and (2) studies of electrical charge on oxides protecting reverse biased silicon p-n junctions. The relationship between hot spots and second breakdown is investigated. Many transistors exhibit second breakdown in a region where there was local heating already at power levels insufficient for second breakdown. Other transistors, however, show no such correlation; second breakdown occurs at spots which initially showed no heating. This second breakdown seems to be initiated through some defect which is, as yet, unknown. The surface studies verified the Atallamodel of charge separation on oxides covering reverse biased junctions. Surface potential measurements indicate that voltages as high as 50% of the applied bias remain across the oxide immediately after bias removal. The buildup and decay of these voltages depend strongly upon surface treatment. Author

N64-12592 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
STUDY OF SOLID-STATE AND TRAVELING-WAVE MASER TECHNIQUES
J. A. De Gruyl, W. W. Heinz, S. Okwit, and J. G. Smith Griffiss AFB, N.Y. Tech. Lab. Nov. 1963 48 p refs
(Contract AF 30(602)-2989)
(RADC-TDR-63-461; AD-425402)

The purpose of this program is to develop improved maser techniques and apply them to an overall maser system. The specific areas of interest of this program are: (1) broad instantaneous maser bandwidth (500 Mc); (2) incorporation of solid-state power limiters to protect the maser from saturating; (3) use of superconducting solenoids to provide the magnetic field for the maser; and (4) investigation of the possibility of using the superconducting tunneling effect to provide the RF pump power to the maser. A theoretical analysis of the broadband traveling-wave masers has been made, and several successful experiments have been performed. General expressions that show the important parameters affecting the broadbanding are given, and practical requirements for the structure and magnetic field are established. An analysis of the ferrite approach to the low-level limiter problem has been made. Author

N64-12614 Aerospace Corp., El Segundo, Calif.
INFLUENCE OF RESONANCE TRANSFER OF LUMINESCENCE DECAY
K. B. Eisenthal and S. Sigel 8 Nov. 1963 20 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-301; TDR-269(4240-30)-3; AD-425560)

The effects of dipole-dipole resonance transfer on the population and decay of excited donor molecules are discussed. The limitation of the previous treatments of this problem to flash excitation is demonstrated. The present treatment is applicable to systems which have achieved a steady state or have been flashed. Expressions are given for the donor quantum yields, the decay of excited donor molecules for flashed and steady-state systems, and the steady-state population of excited donor molecules. Author

N64-12660 New York U., N.Y. School of Engineering and Science
MATERIALS FOR THERMOELECTRIC GENERATORS Final Report
A. Machonis, J. Rivera, and I. Cadoff May 1963 26 p refs (Contract AF 19(604)-8076)
(AFCRL-63-633; AD-425131)

The electronic properties of single crystals of alloys of PbTe and SnTe in various ratios between the two limits are being studied. PbTe and SnTe are isomorphous and form a continuous series of solid solutions. The carrier sign of PbTe can be changed from n type for excess Pb to p type for excess Te. SnTe is p type and extrinsic for all stoichiometric ratios. When more than 15% SnTe is alloyed with PbTe, the alloys become p type. The average carrier concentrations as determined from Hall effect increase with increasing SnTe. The related electronic properties—electrical resistivity, thermoelectric power, and thermal conductivity—follow patterns related to the observed change in carrier concentrations. The investigation of ZnSb was hampered by difficulties encountered in producing single-phase single-crystals. Author

N64-12670 Armour Research Foundation, Chicago, Ill.
DISLOCATION MOBILITY AND PINNING IN HARD MATERIALS THROUGH INTERNAL FRICTION STUDIES [Interim Report, Apr. 1, 1962-Mar. 31, 1963]
P. D. Southgate and K. S. Mendelson Wright-Patterson AFB, Ohio, AF Materials Lab., Jun. 1963 104 p refs
(Contract AF 33(616)-8132)
(ASD-TDR-62-431, Pt. 2; AD-417112) OTS: $2.50

The internal friction due to dislocation motion in silicon crystals which have undergone controlled degrees of plastic deformation near 900° C is measured in the 3-kc to 80-kc frequency region. The observation reported previously, of a thermally activated rise between 600° C and 900° C, is confirmed, the activation energy usually being 1.6 ev, although some less reliable measurements give values below 1.5 ev. The results in this region are consistent with a modification of Brailsford's built-in kink theory of damping. At temperatures above 900° C the increase of internal friction with temperature becomes less, corresponding to an activation energy of about 1 ev. Annealing above 1000° C produces a considerable reduction in the internal friction, while maintaining the same activation energy for the process. The degree of anneal appears to depend on anneal temperature, the temperature of initial deformation, and oxygen content of the crystals. Silicon carbide specimens show little variation of internal friction below 700° C, while above this, an impure specimen showed a rise, with activation energy 2.1 ev. Author

N64-12757 Joint Publications Research Service, Washington, D.C.
INVESTIGATIONS ON DISLOCATION STRUCTURES
29 Nov. 1963 99 p refs Transl. into ENGLISH of 6 articles from various Russian periodicals
(JPRS-22076; OTS-63-41255) OTS: $2.25

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6. SUBSTRUCTURE AND DISTRIBUTION OF DISLOCATIONS IN SINGLE CRYSTAL AND POLYCRYSTALLINE ALUMINUM B. N. Rovinskiy, Ye. P. Kastyukova, and V. G. Lyutsau p 85–96 refs (See N64-12763 04-25)

N64-12758 Joint Publications Research Service, Washington, D.C.
APPLICATION OF STATISTICAL THEORY OF DISLOCATIONS TO DERIVATION OF BASIC RELATIONSHIPS FOR STRENGTHENING CURVES
N. S. Akulov and A. K. Shukevich (Acad. Sci. Byeloruss. SSR) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 1–6 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 7, Jul. 1963 p 453–455 (See N64-12757 04-25) OTS: $2.25

It is shown that, within the framework of Akulov's statistical theory of dislocations, it is possible to obtain more general formulas for metal-strengthening curves; certain equations are presented which occur as special cases. It is also shown that for small deformation equations these expressions give identical relationships, and the mechanism which is the basis of the processes described by the equations is discussed. C.L.W.

N64-12759 Joint Publications Research Service, Washington, D.C.
EFFECT OF DISLOCATIONS ON THE DIFFUSION OF SOME ELEMENTS IN GERMANIUM
I. Feltyn' and U. Ertelis (Acad. Sci. Latvian SSR) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 7–22 refs Transl. into ENGLISH from Latvijas PSR Zinatnu Akad. Vestis (Riga), no. 7, Jul. 1963 p 67–74 (See N64-12757 04-25) OTS: $2.25

The effect of dislocations on the effective diffusion coefficients of gallium, indium, arsenic, and antimony in germanium was investigated. Increases were observed in diffusion coefficients, and this condition is explained as being due to the formation of an atmosphere of impurity ions and vacancies in the vicinity of dislocations where there exist favorable conditions for operation of the vacancy mechanism of diffusion. C.L.W.

N64-12760 Joint Publications Research Service, Washington, D.C.
DISLOCATION STRUCTURE IN THE CONCENTRATED LOADING REGION OF PbS CRYSTALS

A. A. Urusovskaya, R. Tyaagaradzhan, and M. V. Klassen-Neklyudova (Acad. Sci. USSR) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 23–37 refs Transl. into ENGLISH from Kristallografiya (Moscow), v. 8, no. 4, Jul.–Aug. 1963 p 625–631 (See N64-12757 04-25) OTS: $2.25

The dislocations in a rosette, formed by the pressure of a diamond indentor, were studied by a method of selective etching. Deformation was developed by slippage along (100) planes, as a result of which dislocation rosettes on the plane of a cube had only four rays and not eight, as was observed in NaCl crystals. In contrast to NaCl, dislocations in PbS were located to one side of the piercing point, strictly in the slippage planes. Dislocations of small loops originated, apparently, by multiple inclusions. Deformation in the direction of the load action was propagated over long distances by the formation of small loops. Author

N64-12761 Joint Publications Research Service, Washington, D.C.
INTERACTION OF DISLOCATIONS DURING CRYSTAL TWINING
V. I. Startsev, V. Z. Bengus, S. N. Komnik, and F. F. Lavrent'yev (Acad. Sci. Ukr. SSR) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 38–59 refs Transl. into ENGLISH from Kristalografiya (Moscow), v. 8 no. 4, Jul.–Aug. 1963 p 632–640 (See N64-12757 04-25) OTS: $2.25

Experimental investigations were conducted of certain effects, during twinning of crystals of calcite and zinc, that result from the interaction of twinning dislocations among themselves and with other dislocations. Theoretical treatment of these phenomena was conducted. Author

N64-12762 Joint Publications Research Service, Washington, D.C.
ARTIFICIAL SHEAR DEVELOPMENT AND DISLOCATION STRUCTURE IN SODIUM CHLORIDE CRYSTALS
E. M. Nadgornyy and A. V. Stepanov (Phys. and Tech. Inst. A. F. Ioffe) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 60–84 refs Transl. into ENGLISH from Kristallografiya (Moscow), v. 8, no. 4, Jul.–Aug. 1963 p 641–651 (See N64-12757 04-25) OTS: $2.25

The results are given of a study of sodium chloride crystals with different amounts of impurities, from the viewpoint of characteristics of selective etching, dislocation structure of artificial shear, and slip dislocations. The dependence was obtained for the rate of motion of edge and screw dislocations as a function of shear stress. The cited data explain the characteristic behavior of dislocations in these crystals. Author

N64-12763 Joint Publications Research Service, Washington, D.C.
SUBSTRUCTURE AND DISTRIBUTION OF DISLOCATIONS IN SINGLE CRYSTAL AND POLYCRYSTALLINE ALUMINUM
B. M. Rovinskiy, Ye. P. Kastyukova, and V. G. Lyutsau (Machine Building Inst.) *In its* Invest. on Dislocation Structures 29 Nov. 1963 p 85–96 refs Transl. into ENGLISH from Kristallografiya (Moscow), v. 8, no. 4, Jul.-Aug. 1963 p 657–662 (See N64-12757 04-25) OTS: $2.25

The high resolution methods of X-ray diffraction microphotography and microscopy were utilized for investigation of single crystal and polycrystalline specimens of pure aluminum (99.996%). It was shown that a combination of these methods uncovers the substructural components of different scales, the direction and magnitude of their disorientation, and the dislocation distribution. Author

N64-12870 American Optical Co., Southbridge, Mass.
EXPERIMENTAL VERIFICATION OF SUN-POWERED LASER TRANSMITTER [Final Report, Mar. 1962–May 1963]
G. R. Simpson Wright-Patterson AFB, Ohio, AF Avionics Lab. Aug. 1963 119p refs
(Contract AF 33(657)-8619)
(ASD-TDR-63-727; AD-420983)

This report details the effort expended on a program of design and experimentation leading to the delivery of an experimental model of a sun-powered laser transmitter. Analytical work is presented which resulted in the choice of Nd: $CaWO_4$ and Nd:glass as candidates for cw sun-powered operation. The design and fabrication of the transmitter mount, pump optics, and laser cavities is described. Cooling techniques developed (primarily oriented toward $CaWO_4$ although generally applicable to any solid laser material operating at room temperature) and the design of the cooling system are detailed. Experimental evaluation of a number of laser configurations of the materials discussed is presented. Evidence is given of quasi-continuous sun-powered operation of Nd:glass Author

N64-12912* National Aeronautics and Space Administration, Washington, D.C.
FIELD-EMISSION INVESTIGATION OF THERMAL DESORPTION AND SURFACE DIFFUSION OF CESIUM ON TUNGSTEN
L. W. Swanson, R. W. Strayer, F. M. Charbonnier, and E. C. Cooper (Field Emission Corp.) Jan. 1964 42 p refs
(NASA Contract NASw-458)
(NASA CR-22) OTS: $1.25

Measured values of the heat of desorption for neutral cesium atoms vary with cesium coverage from 18 kcal per mole at 1.0 monolayer of cesium to 69 kcal per mole as the degree average heat of desorption for cesium ions of 55 kcal per mole Mv per centimeter had negligible effect, within experimental error, on the heat of neutral desorption at zero coverage. An of coverage approaches zero. Electric field strengths up to 13 is obtained for the range of coverage from 0 to 0.07 monolayer. Measured values of the surface-diffusion activation energy range from 6 to 17 kcal per mole depending on the degree of coverage and the crystallographic orientation of the substrate under the condition of zero electric field at the surface. Application of dc fields of either polarity (ranging from 14 to −22 Mv/cm) is found to produce a significant decrease in the activation energy for surface diffusion. A tentative explanation of this effect is given. Author

N64-12993 Hughes Research Labs., Malibu, Calif.
LASER DEVICES EXPLORATORY INVESTIGATION Interim Scientific Report No. 2, 1 Aug. 1963-31 Oct. 1963
H. V. Winston [1963] 55 p refs
(Contract AF 33(657)-11650)
(AD-423698)

Progress has been made in simplifying the theory of optical resonators so that cavities of any complexity, eventually including the pinhole mode selector, can be conveniently analyzed. The simplified analysis also lends itself to optimization of resonator design. Chromium-doped synthetic spinel exhibits broad fluorescence line width, probably because of disorder in the structure, with chromium ions occupying neighboring sites in both tetrahedral and octahedral coordination. Other possible laser materials have been prepared and studied spectroscopically, including terbium-doped $LaAlO_3$. A rotating mirror pulsed reflector laser has been built and its operating characteristics studied. The conditions for low beam divergence and high-power density at the focus have been established. Stimulated Raman scattering has been observed in a

number of new liquids and in crystals of diamond, calcite, and sulfur, with the generation of a total of 36 new frequencies in the range from 6355 to 8980A. Author

N64-13011* Westinghouse Electric Corp., Baltimore, Md. Air Arm Div.
MIROS PROGRAM Progress Letter No. 4, 20 Aug.-20 Sep. 1963
[1963] 12 p
(NASA Contract NASw-703)
(NASA CR-51425) OTS: $1.60 ph, $0.80 mf

The analytical division of the MIROS program in accordance with the contract schedule was covered. Analysis was limited to the Mercury cell MIROS element absorption problem. An examination of an energy level diagram of mercury reveals that five energy levels need to be considered. These five levels are numbered from one to five corresponding to ascending energy. The rate equations governing transitions between these five levels are given. C.L.W.

N64-13030 Emmanuel Coll., Boston, Mass. Research Language Center
ELECTRO-OPTIC BEHAVIOR OF KH_2PO_4 AND KD_2PO_4-CRYSTALS [ELEFTROOPTISCHES VERHALTEN VON KH_2PO_4- UND KD_2PO_4- KRISTALLEN]
B. Zwicker and P. Scherrer Bedford, Mass., AFCRL Jun. 1963 5 p refs Transl. into ENGLISH from Helv. Phys. Acta 16, 1943 p 214-216
(Contract AF 19(604)-8505)
(E-T-G-63-20; AD-420359)

A measurement of the birefringence at constant field intensity and variable temperature of the ferroelectric crystal KH_2PO_4 is presented. Above the Curie temperature, the relationship between the created birefringence and the applied electric field is linear, whereas in the Curie region saturation phenomena appear. The measurements show that the electro-optic birefringence is exactly proportional to the macroscopic electric polarization of the crystal. J.E.T.

N64-13068* Massachusetts Inst. of Tech., Cambridge
A HIGH SENSITIVITY SOLID STATE LIGHT DETECTOR
Sanford Cohen (M.S. Thesis) Aug. 1963 81 p refs
(NASA Grant NsG 254-62)
(NASA CR-55164; TE 6) OTS: $8.10 ph, $2.63 mf

A gallium arsenide photovoltaic cell is combined to a field effect transistor making a solid-state light detector. This detector is found to be capable of sensing stellar radiation. Author

N64-13094 Texas Instruments Inc., Dallas Semiconductor-Components Div.
UTILIZATION OF ELECTRO-OPTICAL PHENOMENA TO PERFORM ELECTRONIC LOGIC FUNCTIONS Interim Engineering Report, 1 May-31 Oct. 1963
W. T. Matzen and J. R. Biard 13 Dec. 1963 79 p refs
(Contract AF 33(657)-11552)
(TI-03-63-49; AD-425092)

The major portion of work to date has been concerned with the Electro-Optical Device, a four-terminal active element consisting of a GaAs light source optically coupled to a silicon photodetector. Analysis of electrical performance, development of technology, and application studies were included in the program. Agreement between theoretical and measured results verified the analysis of EOD operation. Response time is limited by quantum efficiency and device area. Although the basic logic and memory functions can be performed with the EOD, its use in digital computers does not appear advantageous until integrated arrays can be realized. Other promising applications such as Photon-Coupled Logic and multidimensional data processing are also dependent upon technology for integrated arrays. Author

N64-13126 Emmanuel Coll., Boston, Mass. Research Language Center
POLARIZED PHOSPHORESCENCE AND THE CORRELATION BETWEEN THE POLYCHROISM OF PHOSPHORESCENCE AND THAT OF ABSORPTION AND THE POSITIVE DIRECTION MAGNETO-OPTIC EFFECT MANIFESTED BY THE PHOSPHORESCENCE BANDS OF RUBY AND EMERALD AND THE RELATIONSHIPS BETWEEN EMISSION AND ABSORPTION IN A MAGNETIC FIELD
Jean Becquerel [1963] 12 p refs Transl. into ENGLISH from Compt. Rend. (Paris), v. 151, no. 20, 1910 p 859-861 and v. 150, no. 26, 1910 p 1344-1347 refs
(Contract AF 19(604)-8505)
(E-T-FC-63-1; AD-410816)

The dichroism of phosphorescence was studied utilizing strongly dichroic substances which manifest fine bands. Ruby and emerald were used in the study, and from the results it is concluded that the dichroism of phosphorescence and that of absorption are closely linked. The simultaneity of the inversion of the lines corresponding to each other in the two spectra establishes a primary connection between the two types of polychroism. Author

N64-13148* Massachusetts Inst. of Tech., Cambridge
DETECTION OF SCATTERING LAYERS IN THE UPPER ATMOSPHERE (60-140KM) BY OPTICAL RADAR
G. Fiocco and L. D. Smullin Repr. from Nature, v. 199, no. 4900, 28 Sep. 1963 p 1275-1276 refs
(NASA Grant NsG-419)

Graphical results of accumulated photoelectron counts in 10-km range intervals for July 28-31, 1963, are presented. This interval covers the period of the delta-Aquarids meteor shower. J.E.T.

N64-13153 Ameico, Inc., Mountain View, Calif. Semiconductor Div.
FIELD EFFECT TRANSISTORS. COMPARATIVE EFFECTS OF 1 Mev ELECTRON IRRADIATION ON FIELD EFFECT AND INJECTION TRANSISTORS
C. S. Roberts and J. A. Hoerni Mar. 1963 6 p
(Tech. Bull. No. 1)

Degradation characteristics of semiconductor devices under electron irradiation similar to that found in high-altitude radiation belts show that the field effect transistor will still be operable at total dosages between 1,000 and 10,000 times greater than will be endurable with conventional high gain injection transistors. The degradation of the latter is particularly severe at the low collector current levels used for high input impedance applications. Author

N64-13185* Harshaw Chemical Co., Cleveland, Ohio
RESEARCH AND DEVELOPMENT IN CdS PHOTOVOLTAIC FILM CELLS Fifth Period Progress Report, 26 Jul.-26 Nov. 1963
T. A. Griffin, J. C. Schaefer, and R. W. Olmsted 26 Nov. 1963 26 p refs
(NASA Contract NAS3-2493)
(NASA CR-55212) OTS: $2.60 ph, $0.98 mf

During this period a study was initiated to compare films evaporated from different CdS materials. These films were

compared for crystal size, orientation, resistivity, mobility, and carrier concentration. Cells were also made with these films, and the results are included in the study. Preliminary work was accomplished in designing a new lamination process which would have a short heat and cool cycle, thereby ensuring less damage to the transmission and other physical properties of the plastics. Certain improvements in the cell package are discussed. Equivalent circuit models are also reviewed. Author

N64-13238 Ohio State U. Research Foundation, Columbus Antenna Lab.
TECHNICAL MEMORANDUM ON AN EXAMINATION OF THE ABSORPTION FLUORESCENCE, AND LASER RADIATION SPECTRA FOR SOME COMMERCIAL LASER CRYSTALS
John G. Meadors 30 Aug. 1963 31 p refs
(Contract AF 33(657)-10824)
(BPSN-3630-5237; AD-423567; Rept. 1579-1)

Three commercial laser crystals were studied and compared with published data on similar crystals. The absorption, fluorescence, and laser radiation spectra were examined for three rods in an attempt to shed some light on the tolerance of laser system design. C.L.W.

N64-13406* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ELECTRON EXCHANGE CORRECTION TO THE PHONON DISPERSION RELATION IN METALS
Oldwig Von Roos 1 Oct. 1961 5 p refs Repr. from Phys. Rev., v. 124, no. 1, 1 Oct. 1961 p 71–74
(NASA Contract NASw-6)
(NASA CR-53035; JPL-TR-34-104)

The statistical theory recently developed is applied to an investigation of the dispersion relation of sound waves in metals with special regard to contributions due to electron exchange. It is found that these contributions are by no means negligible in the long-wavelength limit, contrary to current belief. Furthermore, it is shown that the temperature dependence of the renormalized sound frequencies is solely mediated by the temperature dependence of the Fermi–Dirac distribution of the electrons. Author

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see*: 07 Chemistry; and 27 Propulsion.

N64-12705 Frankford Arsenal, Philadelphia, Pa.
GREASES NONREACTIVE WITH MISSILE FUELS AND OXIDIZERS
Joseph Messina Sep. 1963 10 p refs Presented in part at the Natl. Symp. of the Soc. of Aerospace Material and Process Engr., Hollywood, Nov. 1962
(FA-A63-10; AD-422788)

Polytetrafluoroethylene, graphite, and silica greases have been found to be essentially inert and unreactive with fuels and oxidizers, including ethyl alcohol, hydrocarbon fuel, unsymmetrical dimethylhydrazine, diethylenetriamine, a 60-40 mixture of the latter two, a 50-50 mixture of hydrazine and unsymmetrical dimethylhydrazine, hydrogen peroxide, inhibited red fuming nitric acid, nitrogen tetroxide, and liquid oxygen. Impact tests in the presence of lox and N_2O_4 indicate nonsensitivity of the greases at high impact energy levels. The greases exhibit adequate lubricating properties, such as oxidation and mechanical stability, antiwear, extreme pressure, and they are not deleterious to many of the conventional elastomers used in missile systems. The polytetrafluorethylene grease was found to be nonexplosive with aluminum when subjected to mutual shear at high loads. Author

N64-12819 Shell Development Co., Emeryville, Calif.
FUNDAMENTAL RESEARCH ON ADVANCED OXIDIZERS Quarterly Technical Report No. 3, June–Aug. 1963
D. W. Barnum, R. M. Curtis, F. S. Mortimer, and J. N. Wilson [1963] 42 p refs
(Contract DA-31-124-ARO(D)-54; ARPA Order 402)
(S-13892; AD-424753)

The study of "nonbonded" interactions in polyatomic molecules has been continued with the objective of developing an improved bond-energy correlation scheme. It has been found possible to fit many of the Urey–Bradley force constants for the nonbonded interactions between pairs of hydrogen, oxygen, fluorine, chlorine, or bromine atoms to smooth curves which can be described in terms of a reasonable potential function which combines an attractive force of the London type with a repulsion. Parameters of this potential function have been determined from the data. A computer program for extended Hückel-type semi-empirical molecular orbital calculations has been written and tested. The major uncertainty in the estimation of the lattice energy of crystals made up of monatomic ions is the form of the repulsive potential. The form of the repulsive potential and the importance of second-neighbor repulsions have been reexamined for sodium chloride and potassium chloride. The lattice energies and heats of formation of the hypothetical salts NF_4F, NF_4ClO_4, and $(NF_4)_2SO_4$ are estimated by means of an approximate procedure due to Kaputinskii. Author

N64-12839 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POWDERS AND EXPLOSIVES
A. G. Gorst 20 Sep. 1963 278 p refs Transl. into ENGLISH of a book "Porokha I. Vzryuchatyye Veshchestva", Moscow, Gos. Izd. Oboronnoy Prom., 1957 p 3–187
FTD-TT-63-281/1+2; AD-423801)

The following topics are discussed: (1) theory of explosives—general characteristics of explosives and their classification, sensitivity of explosives and the initial impulse, stability of explosives and method of its determination, heat and temperature of explosion, composition, specific volume, and pressure of the products of explosive transformation, the combustion of gaseous and condensed explosives; (2) high explosives; (3) colloid powders; (4) black powder; and (5) pyrotechnics. R.T.K.

N64-12862 General Electric Co., Philadelphia, Pa. Spacecraft Dept.
PROPELLANT STORABILITY IN SPACE Quarterly Research Contract Status Report No. 1, 15 May–30 Sep. 1963
A. D. Cohen et al [1963] 76 p refs
(Contract AF 04(611)-9078)
(AD-425957)

Progress is reported in thermal analysis, structural design and hardware procurement, test preparation and operation, and Malta test-station activities. J.E.T.

N64-12936 Phillips Petroleum Co., Bartlesville, Okla.
GAS TURBINE AND JET ENGINE FUELS Progress Report 2
William L. Streets [Oct. 1963] 19 p refs
(Contract NOw-63-0406-d)
(Rept. 851-63R; AD-422582)

Efforts included: (1) endurance testing of two promising new splash-cooled 2-inch test-combustor designs capable of operating under conditions simulating low-level tactical fighter attack missions and/or submarine search missions by a regenerative turboprop-equipped aircraft; (2) planning and statistical design of a test program to determine whether or not the 0.4 weight percent maximum total sulfur now allowed in JP-5 fuel is a safe level for protection of modern turbine blading alloys from hot gas corrosion. These studies will be carried on with and without ingested sea water to show whether or not fuel sulfur accelerates sea-salt corrosion. Author

N64-12973 Stanford Research Inst., Menlo Park, Calif.
HIGH ENERGY OXIDIZERS IN SOLUTION Technical Progress Report No. 1-Quarterly, 1 Jul.-30 Sep. 1963
W. E. Tolberg and M. E. Hill 31 Oct. 1963 14 p refs
(Contract AF 04(611)-9370; ARPA Order 24, Amend. 64)
(AD-423094)

A literature survey was completed, and an all-monel vacuum system for the production of conductimetrically pure HF was designed and built. Construction of an all-copper vacuum line and a Kel-F conductometric cell and vacuum system was begun. Author

N64-12985 Arde-Portland, Inc., Paramus, N.J.
CRYOGENIC STRETCH-FORMING OF SOLID-PROPELLANT ROCKET CASES Quarterly Technical Report No. 3, 1 Dec. 1962-1 Mar. 1963
George Claffy [1963] 25 p
(Contract DA-30-069-ORD-3501)
(AD-403459)

Five vessel configurations (total of ten vessels) were cryogenically stretched prior to the occurrence of a breakdown in the stretch facility. Two of the configurations incorporated "dog-bone" components and were stretched as part of the program to develop the elliptical head. A simple vessel incorporating a thrust skirt, and two configurations for producing high-strength domes, were also stretched. The computer program, for analytically determining the final shape to be achieved by cryogenically stretching a given preform vessel, was checked against actual data from a stretched vessel. The results indicate that the plasticity equations and the computer program are capable of predicting the stretched shape with a high degree of accuracy. The first simple full-size vessel was assembled during this report period and was rejected for bad welds. The problem proved to be one of dimensional tolerance on the head diameter. Author

N64-12991 Arde-Portland, Inc., Paramus, N.J.
CRYOGENIC STRETCH-FORMING OF SOLID-PROPELLANT ROCKET CASES Quarterly Technical Report No. 4, 1 Mar.-31 May 1963
George Claffy [1963] 19 p refs
(Contract DA-30-069-ORD-3501)
(AD-420080)

Cryogenic stretching and room-temperature hydrotesting of a number of subscale development vessels took place during the report period. The configuration features under investigation in these tests included the forward head, aft head, and skirts. Two simple, full-scale vessels were fabricated and stretched. The purpose of these vessels was to gain experience in the 40 in. diam. in preparation for the full-scale phase of the program. It was necessary to repair the girth welds of one unit due to poor match-up of the joints. Both vessels then reached high stress levels satisfactorily when stretched. One of the vessels was aged after stretching, and achieved 260,000 psi nominal ultimate strength when hydrotested. Author

N64-12999 Aerojet-General Corp., Azusa, Calif.
CRYOGENIC-SOLID COOLING TECHNIQUES Interim Engineering Report, 1 Jan. 1963-31 Mar. 1963
U. E. Gross Apr. 1963
(Contract AF 33(657)-8863)
(Engineering Rept.-0694-01-3; AD-403445)

The technique evolved for solidifying liquid hydrogen and neon to the desired density is described, as are the evaluation of a prototype model pressure-control valve, and completion of the deliverable model of the cryogenic-solid cooler. Author

N64-13099 Stauffer Chemical Co., Richmond, Calif. Richmond Research Center
HIGH ENERGY OXIDIZERS Quarterly Technical Summary Report, 1 Aug.-1 Nov. 1963
K. O. Christe and A. E. Pavlath [1963] 13 p refs
(Contract Nonr-4019(00); ARPA Order 399-62)
(AD-424714)

This report discusses an investigation on chlorinetrifluoride-based complexes. Some modification was made on the vacuum line to allow its use in conductometric titration and molecular-weight determination. At the same time, a dry-box was assembled for use with chlorinetrifluoride and similar corrosive materials. Low-temperature NMR work was repeated, but only qualitative proof was obtained for the ionic structure. The dissociation of the complex was measured in IF_5 and found to be complete within the error of the measurement. The ionic structure was proved by conductometric titration too. The Debye-Scherrer powder diagram was obtained for both $KAsF_6$ and $ClF_2{}^+AsF_6{}^-$. Author

N64-13107 Stanford Research Inst., Menlo Park, Calif.
VISCOELASTIC PROPERTIES OF SOLID PROPELLANTS AND PROPELLANT BINDERS Quarterly Technical Summary Report No. 8, 1 Apr.-30 Jun. 1963
Thor L. Smith and James R. Smith [1963] 26 p refs
(Contract NOw-61-1057-d; ARPA Order 22-61)
(AD-424696)

Dynamic mechanical properties were determined on propellant specimens using the low-frequency shear tester. Data were obtained on specimens having different dimensions and on specimens subjected to (1) different clamping forces, (2) different amplitudes, and (3) frequencies between 0.01 and 16 cps. The storage and loss moduli, $G'(\omega)$ and $G''(\omega)$, were found to depend on the clamping force and on the amplitude. Volume-temperature data were determined at temperatures between about −80° and 20° C on specimens of the polyurethane propellent AEBA-10 which contained 0%, 0.23% and 0.43% moisture. For the specimens containing moisture, a sudden volume increase was observed to occur at about 0° C. Tensile stress-strain curves determined at different strain rates and temperatures were combined to give a characterization of the linear viscoelastic properties of the polyurethane propellant AEBA-10 in terms of the time and temperature dependence on the constant-strain-rate modulus F(t). The modulus F(t) can be represented by the equation $\log [F(t) - 350] = -0.26 \log t + 2.83$ over the range $-8 < \log t < 3$, where F(t) is in psi and t is in minutes. By the use of

interconversion equations which are essentially exact, calculations were made of the storage and loss moduli and of the storage and loss compliances. Author

N64-13205 Sheffield U. (Gt. Brit.)
INVESTIGATION OF COMBUSTION INSTABILITY IN SOLID PROPELLANT ROCKET MOTORS
George Sotter 14 Nov. 1963 40 p refs
(Min. of Aviation Agreement PD/31/014/RI)
(FTCE/18/10/63)

The chemical kinetic behavior of the gas-phase induction zone and explosion zone of double-base propellants is analyzed theoretically through consideration of sixteen reversible chemical reactions involving the twelve species O, H, N, OH, O_2, H_2, H_2O, N_2, NO, CO, CO_2, and N_2O. The formation of HNO is included implicitly by the use of three additional, irreversible, reactions. The important processes leading to flame formation are shown to be: $2NO + H_2 \rightarrow 2HNO (+ H_2 \xrightarrow{fast} 2H_2O + N_2)$ and the water gas reaction. The chemical time lag in response to pressure perturbations is predicted to be 0.0005μ sec. The computer program for the problem is reproduced in easily understood Autocode. Author

N64-13221 Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center
ONE-SIDED STATISTICAL TOLERANCE FACTORS
Dennis E. Nickle 31 Oct. 1963 57 p refs
(PWA-FR-781)

In evaluating many products, an analysis of sample data is necessary to determine whether or not the particular product will adhere to specified tolerances. When the measured parameter has a normal distribution, statistical tolerance factors are used to evaluate the probability that this parameter will meet the specified tolerance. This report provides tables of one-sided normal statistical tolerance factors to solve the following problems. (1) an unbiased estimate (this implies that if estimates were made from many samples of data, the average indicated proportion estimate would be equal to the true value) of the proportion of the distribution exceeding a specified limit; and (2) the proportion of the distribution exceeding a specified limit at a given confidence level. I.v.L.

N64-13260 Princeton U., N.J. Guggenheim Labs.
RESEARCH ON SOLID PROPELLANT IGNITABILITY AND IGNITER CHARACTERISTICS Final Technical Report, 1 Oct. 1961-30 Sep. 1962
Edwin H. Grant, Jr. (M.S. Thesis) and Joseph Wenograd 31 Oct. 1963 68 p refs
(Contract AF-AFOSR-62-91)
(Aeronautical Eng. Rept. 662; AD-425651)

The purpose of this research was to study the ignition of composite solid propellants in a small rocket motor. Hot gaseous products from a small gas-fed pyrogen-type igniter supplied a convective ignition stimulus to the internal surface of a thin-webbed, cylindrical solid propellant grain. Initial experiments were made using two different composite solid propellant compositions and stoichiometric methane-oxygen flames. Values of ignition delay time ranged from 3 to 50 milliseconds depending upon the mass velocity of the igniting gas. In another series of studies heat flux was held constant, and the pressure and oxygen concentration in the flame or test gas was varied systematically. The presence of oxygen (0 to 75 percent by weight) and increased pressure (35 to 110 psia) depressed ignition delay time as much as 90% at high oxygen concentrations. Measurements of ignition delay ranging from 2 to 37 milliseconds were made for one composite solid propellant composition. These results corroborate the importance of gas phase properties in influencing propellant ignition delay. Author

N64-13283* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SOME EXPERIMENTAL AND THEORETICAL SIGNIFICANCES ASSOCIATED WITH IRRADIATED PROPELLANT
Anthony San Miguel and Edward N. Duran 1 Nov. 1963 17 p refs
(NASA Contract NAS7-100)
(NASA CR-53012; JPL-TR-32-518) OTS: $1.60 ph, $0.80 mf

The mechanical properties of polyurethane solid propellant are degraded significantly by irradiation dosages greater than 10^6 rads. Four mechanical tests that provide sufficient data to characterize the degradation are described. These tests consist of (1) swelling, (2) torsion, (3) uniaxial tension, and (4) multiaxial tension and compression. The experimental data are characterized in terms of average molecular weight between cross-links(M_c), percent sol, small-strain shear modulus, tension modulus, and strain energy for increasing irradiation dosage. Conclusions obtained in this study indicate that (1) the usefulness of M_c is questionable with regard to defining ionizing radiation degradation in a composite propellant such as polyurethane, (2) the torsion test is a simple and expedient method that may be used to study irradiated propellant quantitatively, (3) certain aspects of the kinetic theory of rubber elasticity are not quantitatively applicable to polyurethane propellant, and (4) the degradation response of irradiated propellant obtained from a uniaxial tension test typifies the degradation response of irradiated propellant obtained from multiaxial tests. Author

N64-13294 Los Alamos Scientific Lab., N. Mex.
THE DIFFERENTIAL THERMAL ANALYSIS UNIT AT GROUP GMX-3
Stanley V. Dubiel, Jr. and John F. Baytos 24 Dec. 1963 61 p refs
(Contract W-7405-eng-36)
(LAMS-2988) OTS: $1.50

The main feature of the apparatus is an expendable furnace assembly contained in a blast-shielded drawer. This drawer, the programer, the thermocouple reference, the microvolt amplifier, and the X-Y recorder are assembled into a relay rack for ease of operation by the analyst. Calibration of the axes is described, and a simplified procedure is developed for the accurate recording of DTA thermograms on a preprinted chart. Irregularities caused by faulty components and manipulative technique are discussed, and recommended methods are given to remedy each situation. Also presented are a formal procedure for the operation of this instrument with illustrations of the apparatus, schematic diagrams, graphs of temperature vs millivolt output, and typical DTA thermograms produced by this instrument. Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-12685* Hughes Research Labs., Malibu, Calif
ANALYTICAL AND EXPERIMENTAL STUDIES TO DEVELOP ION ENGINE GROUND TESTING TECHNIQUES
R. A. Hubach Arnold Eng. Develop Center, Nov. 1963 48 p refs
(NASA Contract NAS5-517; Contract AF 40(600)-948)
(AEDC-TDR-63-245; AD-423226)

Techniques for ground-testing of ion engines are reviewed. This report discusses procedures for the neutralization of ion beams and the results of experiments measuring the space charge and current neutrality achieved. Results of experiments with the window probe and a new probe for the measurement of beam potential are also presented. Author

N64-12966 Space Technology Labs., Inc., Redondo Beach, Calif.
CIRCUIT ANALYSIS FOR THE INDUCTIVELY DRIVEN PLASMA ROCKET
W. Bernstein, C. L. Dailey, O. O. Fiet, and C. W. Lear 16 Oct. 1962 50 p refs
(Rept. 9868-6006-TU-000)

The magnetic field is assumed to interact with the plasma through a collisionless, diamagnetic, current sheath which separates these two regions and transmits impulse to the plasma. The accelerator circuit is represented as an initially charged capacitor discharging through a flat, annular, drive coil placed adjacent to the closed end of the rocket barrel. Equations describing the current in the circuit and the plasma motion are developed. The solution is obtained in a dimensionless form applicable to any accelerator of this type, and is expressed in terms of basic circuit parameters to describe operation with any combination of physical variables. This analysis indicates that energy conversion efficiencies ranging from 60% to 70% should be attainable. Propulsion efficiencies are in the range 90% to 95%, showing that velocity dispersion effects are less important than losses due to energy remaining in the circuit after the plasma has been ejected. Author

N64-13054* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE ANALYSIS OF HIGH-ENERGY CHEMICAL STAGES FOR INTERPLANETARY MISSIONS
Walter H. Stafford, Sam H. Harlin, and Carmen R. Catalfamo NASA, Washington, Jan. 1964 142 p refs
(NASA TN D-1829) OTS: $2.75

The effect of Earth thrust-to-weight ratios and specific impulses on trajectory parameters has been investigated for hyperbolic escape from, and braking into, an orbit about each of the planets Mars and Venus, also escape from Earth. For the escape trajectories, the thrust vector was applied tangential to the flight path and in the direction of the velocity vector. For the braking-in trajectories, the thrust vector was directed against the velocity vector. Specific impulses of 400 to 500 sec and thrust-to-weight ratios of 0.2 to 1.0 were used. The results of the study are presented graphically. Author

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-12421 Alaska U., College Geophysical Inst.
INFLUENCE OF SOLAR PARTICLE RADIATIONS ON ARCTIC HF PROPAGATION
Leif Owren *In its* Arctic Propagation Studies at Ionospheric Modes of Propagation May 1963 p 1–18 (See N64-12420 04-01)

The solar events discussed occurred in the month of August 1959. The study was based mainly on transpolar pulse transmissions at 12, 18, and 24 mc/s from College, Alaska, to Kiruna, Sweden, and Kjeller, Norway, together with reception of 12, 18, and 30 mc/s pulse transmissions from Thule, Greenland, at College and Kjeller. In addition, ionospheric absorption measurements made in Alaska, Greenland, and Norway have been used. An analysis of the solar–terrestrial events using data from an expanded circuit network shows that the auroral zone and subauroral circuits responded to disturbances induced by solar particle bombardment in the expected manner. However, the 18 mc/s transarctic circuit was found to be more sensitive to auroral-zone absorption events than to polar-cap absorption. R.T.K.

N64-12629 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPECTRAL MEASUREMENTS OF NEAR-SOLAR AUREOLES
T. P. Toropova, N. N. Boyko, and G. A. Kharitonova 10 Oct. 1963 9 p refs Transl. into ENGLISH of an article from Izv. Astrofiz. Inst., Akad. Nauk Kaz. SSR (Alma Ata), v. 14, 1962 p 113–118
(FTD-TT-63-844/1+2; AD-425515)

Spectral characteristics of near-solar aureoles in the region of 4000 A to 6400 A were measured. An aureole photometer was used in combination with a daily sky spectrophotometer with automatic recording of data on a loop oscillograph tape. Results are presented graphically. J.E.T.

N64-12693* National Aeronautics and Space Administration, Washington, D.C.
ON THE STRUCTURE OF MAGNETIC FIELDS IN THE ACTIVE REGION OF THE SUN [K STRUKTURE MAGNITNYKH POLEY V AKTIVNOY OBLASTI SOLNTSA]
V. Ye. Stepanov and S. I. Gopasyuk Jan. 1964 40 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), 1962 v. 28, 1962 p 194–223
(NASA TT F-144) OTS: $1.00

The data obtained from photoelectric measurements of the signals from transverse and longitudinal components of the magnetic field were used to obtain the following: (1) the absolute value of the intensity vector; (2) its direction in space given by the angle γ and the azimuth of the field χ at the level of the photosphere in the active solar region. The active region under investigation was tracked for a period of 8 days from 1 September 1961 to 8 September 1961. Maps showing the distribution of H, $H_{\parallel}$, $H_{\perp}$, γ, and χ are given. In the area of the spots, the average intensity of the transverse fields ($\bar{H}_{\perp}$) is 2.3 times greater than the intensity of the longitudinal fields ($\bar{H}_{\parallel}$). Inside the penumbra, $\bar{H}_{\perp}$ is 1.6 times greater than $\bar{H}_{\parallel}$, and inside the cores, $\bar{H}_{\parallel}$ is greater than $\bar{H}_{\perp}$ by a factor of 1.7. Author

N64-12696* Minnesota U., Minneapolis Cosmic Ray Group
THE MOTION OF LOW-RIGIDITY COSMIC RAYS IN THE EARTH'S MAGNETIC FIELD AND THE EFFECTS OF EXTERNAL FIELDS
William R. Webber 15 Jul. 1963 22 p refs Repr. from J. Geophys. Res., v. 68, no. 10, 15 May 1963
(NASA Grant NsG-281-62)
(NASA CR-67)

A general approach is made to the discussion of motion of low-rigidity cosmic rays in a dipole field; it rests on the characteristics of the motion of these particles in the Alfven regime and a family of trajectories passing near the origin of the dipole itself. The general rigidity range of applicability of the method is discussed. It is found that within this range of applicability the asymptotic directions of the particles outside the earth field may be determined for a wide range of arrival latitudes and arrival directions with respect to the vertical without resorting to the numerical integration of trajectories. The presentation is extended to the earth's real field; asymptotic directions applicable to certain locations are presented and discussed for solar-flare particles and galactic variations detected by neutron monitors as well as lower-rigidity particles detectable only at balloon and satellite altitudes. Author

N64-12950* Geophysics Corp. of America, Bedford, Mass.
A THEORETICAL ESTIMATE OF THE AVERAGE VERTICAL DISTRIBUTION OF TEMPERATURE IN THE MARTIAN ATMOSPHERE Technical Report No. 2
George Ohring Jun. 1962 19 p refs
(NASA Contract NASw-286)
(NASA CR-52414; GCA-TR-62-7-N) OTS: $1.60 ph, $0.80 mf

The average variation of temperature with height in the Martian atmosphere is probably controlled by radiative and convective processes. With the use of a simple theoretical formulation in which it is assumed that convection will extend to that height above which the radiative equilibrium lapse rate is just stable, the average temperature profile is computed. It is assumed that the average surface temperature is 230° K, that there is no absorption of solar radiation in the atmosphere, and that carbon dioxide in an amount equal to 2% by volume is the only important radiating gas. The radiation fluxes are computed with the aid of radiation tables; the radiative equilibrium temperatures are calculated using an iterative procedure. The computed temperature profile is characterized by an adiabatic troposphere extending to about 9 km, above which the temperature continues to decrease with height to an average value of about 90° K for the topmost 5mb layer. Author

N64-12954 Minnesota U., Minneapolis Cosmic Ray Group
SIMULTANEOUS BALLOON OBSERVATIONS AT FORT CHURCHILL AND MINNEAPOLIS DURING THE SOLAR COSMIC RAY EVENTS OF JULY 1961
David J. Hofman and John R. Winckler 1963 17 p refs Repr. from Space Res. III: Proc. 3d Intern. Space Sci. Symp. (Amsterdam), 1963 p 662–675
(NSF Grant 24481)
(CR-55, Suppl.)

A series of 32 balloon flights carrying ionization chambers, nuclear emulsions, and counters were flown during the extensive July 1961 solar cosmic ray outbursts. The most energetic events occurred on July 18 and 20, and the solar particle intensities were found to have rise times after the flare which followed a power law, but a decay which was exponential in nature. The July 20 flare produced a solar X-ray burst, and, measured from this event, the onset time of the particles was 28 minutes. At balloon altitudes the July 18 event showed a count-rate increase considerably more rapid than the July 20 increase. At ground level, however, the reverse is true and the July 20 event is fast. This is evidence for the different scale size of turbulence to which the different energy ranges of particles respond in transit from sun to earth. Considerable detail about the change in Störmer geomagnetic cutoffs associated with the magnetic storm was obtained from flights near Minneapolis. Author

N64-13057* Iowa State U., Iowa City
FURTHER OBSERVATIONS ON THE STARFISH AND SOVIET ARTIFICIAL RADIATION BELTS
J. A. Van Allen Nov. 1963 39 p refs
(NASA Grant NsG-233-62)
(NASA CR-55187; SUI-63-37) OTS: $3.60 ph, $1.37 mf

The peak intensity of electrons in the Starfish belt was initially $J_0 \sim 1.4 \times 10^9$ (cm^2 sec)$^{-1}$ at L = 1.18 on the Equator. By June–July 1963, one year later, it was $J_0 \leq 1.5 \times 10^8$ (cm^2 sec)$^{-1}$ at L = 1.35 on the Equator. The mean lifetime of ~2 Mev electrons at the most durable portion of the Starfish belt (L ~ 1.35) is about 16 months. About 10% of initially injected electrons (dominantly the higher energy ones) remained trapped at the end of one year. A preliminary report on the time history of two of the three artificial radiation belts produced by Soviet high altitude atomic bursts in October-November 1962 is given. The mean lifetime of electrons of E > 250 kev was of the order of 25 days for $2.4 \leq L \leq 3.6$. At $L \geq 3.6$ there were marked natural fluctuations. Thus, in agreement with previous evidence, it is confirmed that trapping lifetimes increase rapidly with increasing altitude (due to diminishing atmospheric density), have a maximum of the order of a year at L ~ 1.4, then decline to values of the order of days to weeks at $L \geq 2.0$ (due to magnetic and electromagnetic perturbations). Author

N64-13059* Iowa State U., Iowa City
HIGH-LATITUDE GEOPHYSICAL STUDIES WITH SATELLITE INJUN III PART III: PRECIPITATION OF ELECTRONS INTO THE ATMOSPHERE
B. J. O'Brien [1963] 115 p refs
(NASA Grant NsG-233-62; Contract N9onr93803)
(NASA CR-55173; SUI63-31) OTS: $9.60 ph, $3.65 mf

A general analysis is made of the precipitation of electrons with energy $E_e \geq 40$ Ke into the atmosphere over North America. Measurements were made principally with three directional Geiger tubes on the magnetically oriented satellite Injun III. It is shown that the intensity of electrons mirroring at the satellite altitude increases rather than decreases when precipitation occurs, for example, over an aurora. The precipitation process is such that the angular distribution of electrons tends to approach isotropy over the upper hemisphere at the satellite altitude. The flux of electrons with $E_e \geq$ 40 ke backscattered by the atmosphere is about ten percent of the precipitated flux. No events have been found where the upflux exceeded the downflux, and it is concluded that most acceleration processes take place high above the satellite, accelerating electrons preferentially parallel to the magnetic-field lines. Author

N64-13164 Joint Publications Research Service, Washington, D.C.
THE HEAD SHOCK WAVE IN FRONT OF THE EARTH AND ITS EFFECT ON THE RADIATION BELTS
M. A. Gintsburg 16 Jan. 1964 6 p refs Transl. into ENGLISH of an article from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 3, Nov.–Dec. 1963 p 1127–1128
(JPRS-22759; OTS-64-21305) OTS: $0.50

An explanation of the results from Pioneer I concerning the pulses of the magnetic field between 12 and 14 R_e (where R_e is the earth's radius) is presented. It is indicated that the system of pulses observed as these distances by means of Pioneer I and Pioneer V, is nothing other than the front of a noncolliding head shock wave. This front is fixed relative to the earth, but

moves relative to the plasma of the solar wind with a velocity (on days free of magnetic disturbances) of u = (3 to 5) × 10^7 cm/sec (corresponding to a Mach number of M = u/v_A, where v_A is the Alfvén velocity of the flux in the plasma). Thus, when calculating the width of the pulse $\underline{d}$ its duration τ should be multiplied by the velocity of the rocket V = 1.5 km/sec. Measurements made by means of the Pioneer I yield τ = 5 to 10 sec, that is, $\underline{d}$ = 7.5 to 15 km. This value corresponds to the width of the pulse according to the theory of Adlam and Allen. Also, the acceleration of electrons in the radiation belts by plasma waves, which are continuously generated by a head shock wave is discussed. I.v.L.

N64-13173 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

OBSERVATIONS IN THE ANTARCTIC OF SOLAR COSMIC RAY EVENTS IN 1962 AND EARLY 1963

A. D. Goedeke and A. J. Masley [1963] 16 p refs Presented at the 3rd Western Natl. Meeting, of Am. Geophys. Union, Boulder, Colo. 26–28 Dec. 1963

(NSF-Grant C-301)

(Douglas Paper 1843)

The role of the riometer used and a discussion of the observation of the February 1962, October 23, 1962, February 9, 1963, and April 15, 1963 solar events are presented. J.E.T.

N64-13183* Southwest Center for Advanced Studies, Dallas, Tex.

SOLAR COSMIC RAY PROPAGATION CHARACTERISTICS

K. G. Mc Cracken [1963] 11 p For Presentation at the Intern. Conf. on Cosmic Rays, Jaipur, India Submitted for Publication

(NASA Grant NsG-269-62)

(NASA CR-55150) OTS: $1.60 ph, $0.80 mf

Various properties of solar cosmic radiation are summarized for the purpose of inquiring into the adequacy of current models describing the production of cosmic rays. It is concluded that any model must explain the following observed features of cosmic-ray flare effects: (1) at high energies a bias towards the western limb of the sun and at low energies a bias to the center of the solar disc; (2) rapid access to the earth of some cosmic rays—marked anisotropies (short-lived) oriented some 60° to the west of the sun and some scattering of particles enroute to the earth; (3) diffusion-like access of a large majority of particles; (4) attributing few flare effects to flares on the back-side of the sun; (5) trapping of solar cosmic rays by the mechanism responsible for the Forbush decrease; (6) the spectrum frequency being a good approximation to an exponential in rigidity, the characteristic exponent P_o being a function of time; and (7) the decay of flare effect often following a law similar to that given by classical diffusion— the diffusion mean free path being at times independent of rigidity. P.V.E.

N64-13184* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

THE SOLAR WIND VELOCITY AND ITS CORRELATION WITH GEOMAGNETIC, SOLAR AND COSMIC RAY ACTIVITY

Conway W. Snyder, M. Neugebauer and U. R. Rao (Graduate Res. Center of the Southwest) 1963 4 p Presented at the Intern. Conf. on Cosmic Rays, Jaipur, India Submitted for Publication

(NASA Grant NsG-269-62)

(NASA CR-55151) OTS: $1.10 ph, $0.80 mf

A discussion is presented of the correlation of plasma velocity measured by the Mariner II spacecraft with various indices of solar and terrestrial activity. Results of some of the experiments carried by Mariner II are also presented. The experimental results indicate the following conclusions: (1) There is always a measurably large plasma flow from the direction of the sun—the plasma velocity varied from day to day. (2) Plasma velocity is not correlated with the cosmic-ray diurnal amplitude, with time of maximum, or with the overall solar activity. (3) Plasma velocity is very strongly correlated with the planetary indices. (4) The plasma velocity showed a very strong 27-day recurrence tendency and a close association with M-region storms, thus indicating that M-regions are emitters of high-velocity plasma P.V.E.

N64-13208* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE MOTION OF CHARGED PARTICLES IN THE GEOMAGNETIC FIELD

Ernest C. Ray Repr. from Ann. Phys. v. 24, Oct. 1963 p 1–18 refs

(NASA RP-99)

An approximate first integral is constructed of the equations of motion of a charged particle in a static magnetic field. The integral is analogous to the Størmer integral, but it is not required that the field have axial symmetry in order for the integral to be exact. The integral reduces to that of Størmer when the field does possess axial symmetry. It is used to obtain results concerning trapped particles and cosmic rays previously derived using a variety of techniques. The new technique can readily be extended to cover situations not previously tractable. Author

N64-13264* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

SCIENCE SUBSYSTEM OPERATIONS, RANGER FOLLOW-ON

R. P. Del Negro 15 Apr. 1963 148 p refs

(NASA Contract NAS7-100)

(NASA CR-53022; JPL-TM-33-127) OTS: $11.00 ph, $4.64 mf

A brief description is given of equipment and operations techniques common to many of the Ranger Follow-On spacecraft series, together with details of the equipment developed for the Ranger series 7 to 9. Ground support equipment and testing facilities are also described. Some of the areas covered are: system operation, television experiment, cosmic dust experiment, low energy solar plasma experiment, electron flux detector experiment, ionization chamber experiment, particle flux experiment, and the data automation system. C.L.W.

N64-13272* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

HIGH DISPERSION SPECTRA OF THE OUTER PLANETS: I. JUPITER IN THE VISUAL AND RED

Hyron Spinrad and Laurence M. Trafton Repr. from Icarus, v. 2 Jan. 1963 p 19–28 refs

(NASA Contract NAS7-100)

(NASA CR-53003; JPL-TR-32-437)

High dispersion spectrograms of Jupiter partially resolve the red methane and ammonia bands and show new, weak lines. At times the Jovian ammonia and methane gases do not co-rotate with the cloud layer as evidenced by the anomalous inclination of their absorption lines. The measures are discussed in detail. The Jovian CH_4 lines in the λ6190 band have been compared in detail with their laboratory and Saturnian counterparts. An upper limit to the total pressure

above the Jovian cloud layer is estimated; from these data and a new H_2 abundance of about 27 km-atm, a limit to the H/He ratio is deduced. We find the H/C ratio for Jupiter, Saturn, and Uranus to be far below the corresponding ratio in the Sun and other stars. The locations of two new lines tentatively ascribed to Jupiter are given; a search for some other absorbers in this spectral region gave negative results. Author

N64-13273* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

MARS ATMOSPHERE ENTRY PARAMETRIC STUDY

J. M. Brayshaw 31 Oct. 1963 109 p refs (See N63-23806 24-29)

(NASA Contract NAS7-100)

(NASA CR-53020; JPL-TR-32-458, Rev. 1) OTS: $9.10 ph, $3.47 mf

The expected extreme model atmospheres, as well as the anticipated extremes of initial entry velocity, entry angle, and ballistic coefficient were included in the study. As functions of these variables, the following parameters are plotted in graphical form: (1) flight path acceleration vs altitude; (2) Mach no. vs altitude; (3) dynamic pressure vs altitude, (4) heating rate vs altitude; (5) flight path angle vs altitude; (6) atmospheric velocity vs altitude; (7) altitude vs time; and (8) altitude vs planet centered angle. In addition, summary plots of peak heating rate, peak acceleration, unretarded impact velocity, and altitude for parachute deployment are shown as a function of entry angle for the extremes of ballistic coefficient and model atmosphere. Author

N64-13274* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

HIGH DISPERSION SPECTRA OF THE OUTER PLANETS. II. A NEW UPPER LIMIT FOR THE WATER VAPOR CONTENT OF THE MARTIAN ATMOSPHERE

Hyron Spinrad and E. H. Richardson Repr. from Icarus, v. 2, Jun. 1963 p 49–53 refs

(NASA Contract NAS7-100)

(NASA CR-53004; JPL-TR-32-462)

A very high dispersion spectrogram of Mars has been searched unsuccessfully for Martian H_2O lines near λ 7200. The plate was taken on a very dry night when the Doppler shift was sufficient to displace any Mars H_2O lines 0.29 A from their telluric counterparts. From this data, an upper limit has been derived for the integrated Martian water vapor abundance of approximately 3.5×10^{-3} gm/cm^2 (35 μ). The practical limits for detection of Martian water vapor by Earth-bound, balloon, and space probe techniques indicate that spectroscopic observations from the Earth can be refined to a point where they are at least as sensitive as present infrared space experiments. Author

N64-13282* Jet Propulsion Lab., Calif. Inst., of Tech., Pasadena

THE SOLAR-WIND VELOCITY AND ITS CORRELATION WITH COSMIC-RAY VARIATIONS AND WITH SOLAR AND GEOMAGNETIC ACTIVITY

Conway W. Snyder, Marcia Neugebaur, and U. R. Rao (Mass. Inst. of Tech., Cambridge) 15 Oct. 1963 19 p refs

(NASA Contract NAS7-100; Contract AT(30-1)-2098)

(NASA CR-53027; JPL-TR-32-514) OTS: $1.60 ph, $0.80 mf

Mariner II obtained data on the interplanetary plasma during the period August 29, 1962, through January 3, 1963. The daily average of plasma velocity is presented and compared with data on cosmic-ray diurnal variations and with indices of solar and geomagnetic activity for this period. The only close correlation found is that between plasma velocity and the geomagnetic index K_p. The plasma velocity showed a very strong 27-day recurrence tendency and a close association with M-region geomagnetic storms, which indicates that solar M-regions are emitters of high-velocity plasma. No dependence of plasma velocity on solar distance between 1.0 and 0.7 AU could be detected. Author

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-12659 Boston Coll., Chestnut Hill, Mass. Ionospheric Research Lab.

DETERMINATION OF THE ORIENTATION OF THE AXIS OF A ROCKET OR SATELLITE IN ITS TRAJECTORY OR ORBIT Scientific Report No. 1

Rene J. Marcou 16 Aug. 1963 19 p

(Contract AF 19(604)-7304)

(AFCRC-63-871; AD-424989)

A method is developed for determining the aspect of the axis of a rocket or satellite with respect to an earth-based system of coordinates for the case where these bodies undergo a constant precessional motion about some fixed direction. The analysis is based on data obtained from a magnetometer mounted on the body so as to give the axial component of the earth's magnetic field and a sun sensor which measures the angle between the sun vector and the axis of the body. The only information needed for the determination of the aspect of the axis is the maximum and minimum axial components of the earth's magnetic field, the maximum and minimum angles between the axis of the body and the sun vector, the time sequence in which these maximums and minimums occur, and the angular velocity of precession. Author

N64-12678 Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

ENGINEERING PROBLEMS IN A LUNAR ENVIRONMENT

Donald D. Carlson and George Mac Farlane July 1963 30 p refs

(AEDC-TDR-63-169; AD-422956)

The principal characteristics of the cislunar and lunar, environments are identified, and the influences that such environmental parameters have upon engineering designs applicable to lunar operations are outlined. Basic astronomical data and some illustrations of typical lunar topography are also included. Author

N64-12689* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RETURN TRAJECTORIES FROM THE MOON: SOME LIMITS DUE TO RESTRICTIONS ON ENTRY RANGE AND LANDING LIGHTING CONDITIONS

Luigi S. Cicolani Washington, NASA, Jan. 1964 25 p refs (NASA TN D-2127) OTS: $0.75

Trajectories suitable for Apollo-type lunar missions must satisfy a large variety of constraints. This paper is concerned with two possible constraints for the return phase of the mission; namely, trajectories which (1) require entry ranges less

than 5,000 nmi, and (2) permit landing within a 4-hour period following sunrise. The general characteristics of trajectories which satisfy these constraints are discussed, and those combinations of lunar launch time, orbital plane inclination, and landing site latitude which allow such trajectories are indicated. Author

N64-12709 Manchester Coll. of Science and Tech. (Gt. Brit.)
LABORATORY SIMULATION OF LUNAR LUMINESCENCE
Annual Summary Report No. 3
J. E. Geake, M. D. Lumb, and J. Derham Aug. 1963 6 p refs (Grant AF EOAR 61(052)-379)
(AFCRL-63-759; AD-269842) OTS: $2.60

A proton accelerator, to be used for corpuscular excitation of luminescence in meteoric and other samples, has been completed. The spectrum of any luminescence excited, either by UV or by protons, is investigated by means of a photoelectric spectrophotometer. The proton accelerator consists of an ion source, in which pure gas is ionized by power from a radio-frequency oscillator, an accelerating tube in which the protons are accelerated to energies of up to 120 Kev, and a sample chamber. Results show that most of the samples investigated are damaged quickly by the proton beam—the luminescence intensity falls off, but the spectral distribution stays the same. These results present a difficulty in explaining how the luminescence of the materials on the moon have survived radiation damage. P.V.E.

N64-12714* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EARTH ORBITAL SATELLITE LIFETIME
James E. Ladner and George C. Ragsdale Washington, NASA, Jan. 1964 32 p refs
(NASA TN D-1995) OTS: $1.00

A definition of several factors important in the accurate prediction of orbital lifetime is presented. The factors are atmospheric variations, vehicle drag coefficient, propellant boiloff, and vehicle attitude stabilization. Curves are given for obtaining planning estimates of lifetime using a minimum number of vehicle and orbital parameters. Such estimates will have an uncertainty of +150 percent and −70 percent. The curves are valid for circular and eccentric orbits lying wholly between the altitudes of 150 and 500 km. Solar radiation affects the atmosphere in two ways: a general expansion (or contraction) with the 11-year solar cycle and a diurnal bulge in the direction of the sun. Orbital lifetime may be increased by 150 percent or decreased by 60 percent due to the solar cycle effect. The diurnal bulge effect increases with altitude and may cause a decrease of 20 percent for a 500-km circular orbit from the lifetime predicted by neglecting the bulge. Author

N64-12718* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SECONDARY ERRORS AND OFF-DESIGN CONDITIONS IN OPTIMAL ESTIMATION OF SPACE VEHICLE TRAJECTORIES
Gerald L. Smith Washington, NASA, Jan. 1964 68 p
(NASA TN D-2129) OTS: $1.75

To estimate a space vehicle's trajectory by means of linear filter theory, the navigation system and its inputs must be represented mathematically. For the estimation system to be optimum, all error sources, including those of secondary importance, must be represented in the mathematical model. This generally means that every error affecting system performance is regarded as a state of the system and in an optimal system must be estimated along with the other state variables. Astrodynamic constant uncertainties and bias-type observation errors are used to illustrate this principle and the technique by which errors are represented as state variables. Numerical results are given which show the effect of these two types of errors on the performance of a circumlunar midcourse guidance system. Equations are developed which can be adjoined to the system equations for computing the performance of the nonoptimal system, using as an example a system with uncompensated bias-type observation errors mixed with the random errors for which the system is designed. Author

N64-12799 Joint Publications Research Service, Washington, D.C.
SLOPE ANGLES OF LOOSE MATERIALS AND HYPOTHESES OF THE DUST NATURE OF THE LUNAR SURFACE
N. S. Orlova *In its* Dust Nature of the Lunar Surface and Determining Figure of the Earth Through Gravity Anomalies 15 Jul. 1963 p 1–9 refs (See N64-12798 04-01) OTS: $0.75

Evidence is presented that dust or other loose cover cannot provide a surface whose unevenness would correspond to the photometric relief of the lunar surface. Laboratory experiments were performed to determine the angle of natural slope for various samples of loose materials (sand, dust, volcanic ash, etc.) heaped into a natural cone. Most of the materials gave slope angles of 25° to 30°; the greatest value, 45°, was obtained for powdered clay. Photographs of natural volcanoes were examined to determine the slope angles of the volcanic cones; most ranged from 30° to 35° and none exceeded 45°. Models with a pitted surface whose maximum angles of nonuniform slope were equal to 45° were examined at various angles of illumination; the resulting curves were not similar to those obtained photometrically for the lunar surface. The conclusion is drawn that, if the angles of natural slope of natural materials have the same value under lunar conditions as on earth, then enormous expanses covered by noncemented dry materials do not exist on the lunar surface. M.P.G.

N64-12876* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TOUCHDOWN DYNAMICS ANALYSIS OF SPACECRAFT FOR SOFT LUNAR LANDING
Robert E. Lavender Washington, NASA, Jan. 1964 39 p refs
(NASA TN D-2001) OTS: $1.00

Parameters used in the analysis include the local lunar slope, coefficient of friction, initial touchdown vertical and horizontal velocity components, vehicle weight and radius of gyration, height of the center of gravity, displacement of the center of gravity from the vehicle's longitudinal axis, thrust of stabilization rocket motors, crushing force of energy absorbing material in the leg struts, and number of legs. Results show that the lunar slope, which was varied up to 40 degrees, and the coefficient of friction have a large effect on the landing gear diameter required for touchdown stability. The initial touchdown vertical and horizontal velocity components also have a large influence on the required landing gear diameter. Variations in the height of the center of gravity, displacement of the center of gravity from the vehicle's longitudinal axis, vehicle weight and radius of gyration, and crushing force of the energy absorbing material have less influence on the landing gear design. The use of a stabilization rocket motor is highly effective in providing adequate touchdown dynamic stability. With a properly chosen scheme for providing motor ignition, tumbling of the vehicle under severe conditions of lunar slope and friction can be prevented with a motor of relatively low total impulse. Author

N64-12890 Joint Publications Research Service, Washington, D.C.
EXPLORATIONS OF OUTER SPACE AND THE OUTER LAYERS OF THE ATMOSPHERE
A. A. Blagonravov *In its* Outer Space Explorations 4 Dec. 1963 p 1–22 (See N64-12889 04-01)

The principal results of explorations of outer space were carried out with the aid of: (1) the automatic interplanetary station, "Mars-1;" (2) satellites of the "Kosmos" type intended for study of the outer layer of the atmosphere and the outer space which surrounds the Earth; (3) the launching of exploratory rockets with the purpose of recording the temperature, density, and winds in the upper layers of the atmosphere; and (4) radiolocation of the planets Mercury, Venus, and Mars with the aid of ground-based means. R.T.K.

N64-12911* National Aeronautics and Space Administration, Washington, D.C.
THE EXPLORATION OF INTERPLANETARY AND INTERSTELLAR SPACE News Release
Oran W. Nicks 8 Jan. 1964 49 p refs Presented to the Staff and Teachers of the San Francisco City Schools, 8 Jan. 1964 Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

According to Mr. Oran W. Nicks, the exploration of objects in space is of the greatest importance. The nature of the objects in space is discussed as well as the possibilities they afford for exploration. The technological aspects of interplanetary flight, some of the findings of the Mariner II spacecraft on its journey from Earth to the vicinity of Venus, and the possibility of exploring objects outside our solar system are among the topics discussed. R.T.K.

N64-12963 Cornell U., Ithaca, N.Y. Center for Radiophysics and Space Research
SECULAR CHANGES IN THE SOLAR SYSTEM
Peter Goldreich Feb. 1963 79 p refs
(Supported by NSF)
(CRSR-128)

This paper on secular changes in the solar system is divided into the following sections: (1) the inclination of satellite orbits about an oblate precessing planet—it is shown that satellite orbits about an oblate precessing planet will maintain a constant inclination to the planet's equator under the condition that the motions of the satellite's pericenter and of its ascending node on the equator plane are rapid when compared to the precession of the planet; (2) the eccentricity of satellite orbits in the solar system—two mechanisms which affect the eccentricities of satellite orbits are discussed (the tide raised on the planet by the satellite and the tide raised on the satellite by the planet); and (3) an explanation of the frequent occurrence of near-commensurate mean motions in the solar system—it is shown that special cases of near-commensurate mean motions are stable under tidal forces, and the significance of these stable configurations on the evolution of satellite systems is discussed. P.V.E.

N64-13014* Hughes Aircraft Co., Culver City , Calif. Aerospace Group
SURVEYOR SPACECRAFT SYSTEM. TOUCHDOWN DYNAMICS STUDY
R. E. Deitrick and R. H. Jones Jan. 1963 277 p refs
(NASA CR-52080; SSD-3030R;) OTS: $17.50 ph, $8.51 mf

The touchdown dynamics phase of the Surveyor mission covers the period from vernier engine cutoff until the vehicle comes to rest on the lunar surface. The period of primary concern begins with the first contact of the vehicle on the surface and continues through the ensuing motion during which the remaining kinetic energy is absorbed. Design of the landing gear system is based on evaluation of the toppling stability and representative package inertia loads resulting from this motion. The Surveyor is designed to provide for soft landings with vertical and lateral velocities of up to 20 fps and 7 fps, respectively, on a 15-degree slope. The final Surveyor landing gear configuration consists of a tripod arrangement of legs, each of which incorporates a shock absorber containing an orifice-type damper and liquid spring. The legs provide the stability against toppling required for landing on slopes as well as supplying a portion of the energy absorption capability. In conjunction with the legs, three 8-inch-long aluminum honeycomb crushable blocks are attached to the spaceframe near the leg junctions to provide for absorption of the remaining energy at minimum weight. Author

N64-13028* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE DISTANT GEOMAGNETIC FIELD. 5. LONG-PERIOD OSCILLATIONS
C. P. Sonett Repr. from J. Geophys. Res., v. 68, no. 24, 15 Dec. 1963 p 6371–6376 refs

Long-period magnetic oscillations ($\geq$ 100 seconds) seen on the Pioneer 1 flight are discussed. The indication is that these oscillations are comparable in scale to the magnetosphere and are primarily radial, that is, they are contained in geomagnetic meridian planes. The energy densities agree with the fluctuation level in the free-stream solar wind and suggest the excitation mechanism discussed by Dessler based on a fluctuating solar wind pressure. Author

N64-13066* Geophysics Corp. of America, Bedford, Mass.
A STUDY OF THE METEOROLOGY OF MARS AND VENUS
Quarterly Progress Report No. 3, 6 Jul.-5 Oct. 1963
[1963] 35 p 4 refs
(NASA Contract NASw-704)
(NASA CR-55165) OTS: $3.60 ph, $1.25 mf

Several topics of importance to the meteorology of Mars and Venus were investigated. Atmospheric tides in the Martian atmosphere were discussed. Techniques for constructing thermodynamic diagrams for the Martian atmosphere were developed, and actual diagrams are under construction. Meteorological studies of Venus focused on two problems, both of which are related to planetary and atmospheric temperatures. The first problem was an estimate of the amount of solar radiation absorbed by carbon dioxide in the atmosphere of Venus. The second problem concerned the temperature variation with altitude in the atmospheric layer between the planet's surface and the base of the cloud layer. Techniques for computing the radiative equilibrium distribution of temperature in this layer were developed. I.v.L.

N64-13136 Bellcomm, Inc., Washington, D.C.
LUNAR LOGISTIC SYSTEM SCIENTIFIC FACILITY
C. A. Pearse and H. W. Radin 31 Jan. 1963 16 p refs

The major objective of this study is to examine possible methods for increasing the overall scientific capability of early Project Apollo missions, utilizing a nominal 1500-pound payload delivered by a C1-B, automated LEM, or C-5 Lunar Logistic Vehicle. Of the several alternatives considered, the establishment of a lunar surface laboratory is found to be the most effective means of enhancing the early scientific capability. Some major advantages of a lunar surface laboratory are cited, and

a balanced group of pertinent experiments is proposed. These experiments are separated into two broad categories: experiments to obtain specific information about the moon, and experiments which use the moon as a stable space platform from which to make astrophysical observations. Author

N64-13158 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FORWARD TO MARS
28 Jan. 1963 5 p Transl. into ENGLISH from Izv. (Moscow), No. 15, 1962 p 1-4
(FTD-TT-63-94/1+2+4; AD-400548)

On November 12, 1962, a routine communication session was held with the automatic interplanetary station Mars I. On commands sent from the distant space-communication center, transmitters on board were turned on, measurements of the trajectory were performed, and telemetric information was received. This information showed that the temperature and pressure in the shell of the interplanetary station were within the prescribed limits and that solar and chemical batteries were working normally. Station Mars I was 3,650,000 kilometers away from Earth at the instant of the communications session. In succeeding sessions, instruments will send data to Earth from the entire gigantic trajectory of the rocket and will send news on the composition of the interplanetary environment. I.v.L.

N64-13189* Stanford U., Calif.
REALIZATION OF MINIMUM CONTROL EFFORT OPTIMAL CONTROL
Andrew Craig and Irmgard Flügge-Lotz Oct. 1963 115 p refs Presented at the Winter Ann. Meeting, Philadelphia Submitted for Publication
(NASA Grant NsG-133-61; Grant AF-AFOSR-137-63; Grant AF-AFOSR-235-63)
(NASA CR-55149; SUDAER-171) OTS: $9.60 ph, $3.65 mf

Application of Pontryagin's Optimal Principle to control system problems eventually requires that a two-point boundary value problem be solved. For plants whose equations of motion are greater than second order this represents a formidable barrier in realizing a practical feedback control. When the criterion for optimization is minimum fuel consumption, choice of time for solution may be used as a free parameter, and this plus consideration of the efficiency of application of control leads to an approximate method which avoids this difficulty. A heuristic analysis of the geometry of state-space trajectories, using true optimal solutions as a guide, provides laws for constructing a feedback control from the state variables. It further provides a knowledge of the bounds of performance of the mechanized suboptimal control and an estimate on the performance of a minimum time control for comparison purposes. Author

N64-13275* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE DETERMINATION AND CHARACTERISTICS OF BALLISTIC INTERPLANETARY TRAJECTORIES UNDER THE INFLUENCE OF MULTIPLE PLANETARY ATTRACTIONS
Michael A. Minovitch 31 Oct. 1963 69 p refs
(NASA Contract NAS7-100)
(NASA CR-53033; JPL-TR-32-464) OTS: $6.60 ph, $2.27 mf

The determination of free-fall trajectories to several planets is essentially the well-known, unresolved *n*-body problem. Thus, in order to calculate these trajectories, certain simplifying assumptions must be made. This report is based upon one fundamental assumption: At any instant, one, and only one, gravitating body influences the vehicle's motion. Under this assumption, almost all of the vehicle's trajectory will consist of arcs of different ellipses with the Sun at a focus; however, when the vehicle comes sufficiently close to a passing planet, its trajectory with respect to this planet will be hyperbolic while the Sun's influence is neglected. This report contains the results of a study of such conic trajectories; it also contains results of a numerical study performed. These calculations show that, by utilizing multiple planetary trajectories, many interplanetary missions requiring very large launch vehicles can be carried out with much smaller vehicles by simply changing their mission profiles. This is particularly true for missions to Mercury and manned missions to Mars. Author

N64-13278* Jet Propulsion Lab., Calif. Inst., of Tech., Pasadena
A SIMPLIFIED MODEL OF MIDCOURSE MANEUVER EXECUTION ERRORS
C. R. Gates 15 Oct. 1963 8 p refs
(NASA Contract NAS7-100)
(NASA CR-53032; JPL-TR-32-504) OTS: $1.10 ph, $0.80 mf

Midcourse maneuvers are commonly employed in ballistic lunar and interplanetary spaceflight, and errors committed in executing these maneuvers contribute to target dispersion. A simplified model of such execution errors was developed. The model is presented along with an expression for its second moment. Author

N64-13281* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
A DYNAMIC PROGRAMMING ANALYSIS OF MULTIPLE GUIDANCE CORRECTIONS OF A TRAJECTORY
Carl G. Pfeiffer 15 Nov. 1963 20 p refs
(NASA Contract NAS7-100)
(NASA CR-53000; JPL-TR-32-513) OTS: $1.60 ph, $0.80 mf

The problem of deciding when to apply guidance corrections to the perturbed trajectory of a spacecraft is treated from the dynamic programing point of view. It is assumed that the objective of the guidance correction policy is to minimize the expected value of the squared error at the final time, subject to the constraint that the total correction capability expended be less than some specified value. It is shown that a correction should be performed when a certain "switching function" passes through zero. Assuming that the orbit determination procedure has been prespecified, and that the statistics of the correction errors are known, the switching function is found to depend upon the instantaneous state of the system, which is composed of (1) the estimate of the trajectory perturbation to be corrected, (2) the variance of the error in this estimate, and (3) the correction capability of the spacecraft. Equations for computing the switching function are derived, and a numerical example is presented. Author

N64-13334* Boston U., Mass.
LUNAR CRATER STATISTICS: THE HIGHLAND REGIONS Research Report No. 7, Aug. 1963
David Friesen Aug. 1963 31 p refs
(NASA Grant NsG-246-62)
(NASA CR-55172; *Its* Chem. Contrib. Ser. II, No. 25) OTS: $3.60 ph, $1.13 mf

The crater diameter (D) vs cumulative frequency of occurrence (N) for lunar craters can be described by equations of the form $N = AD^B$ with the constants A,B empirically determined from actual counts of craters. It is found, however, that a single set of constants does not adequately describe the cumulative distribution function. Two sets of constants are required, their average value for a normalized area (10^6 km) being:

(1) D >40 km, A = 30,350, B = −2.392;
(2) D <40 km, A = 9,035, B = −1.263.

Author

N64-13338 Academy of Sciences (USSR), Moscow Computing Centre
NEW METHOD FOR SOLUTION OF PROBLEMS OF OPTIMAL TRANSFER THEORY
N. Y. Bagaeva and N. N. Moiseev [1963] 17 p refs Presented at the 14th Intern. [Astronautical Federation] Congr. (Paris), Sep. 1963

The possibility of a direct solution to the problems of optimal control associated with space vehicle dynamics, in which these problems are not reduced to boundary problems for ordinary differential equations, is discussed. A description of an algorithm for sequential improvement of control is presented. The formation of a zero approximation and efficient solution to the problem of optimal control with respect to transfer time of the system from one point to another and also to a neighboring point in phase space, is included. R.T.K.

N64-13339 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
PERTURBATIONS OF A GEOSTATIONARY SATELLITE. 2. LUNISOLAR EFFECTS
R. R. Allan London, Min. of Aviation, Sep. 1963 20 p refs (RAE-TN-SPACE-47)

The plane of an equatorial synchronous orbit initially tilts at a mean rate of between 0.75 and 0.95°/year about a direction in the equatorial plane nearly at right angles to the intersection with the ecliptic. A velocity capability of between 40 and 50 meter sec^{-1} per year would be required to maintain the satellite in the equatorial plane. Although this is an order of magnitude greater than is required to counteract the effects of the ellipticity of the equator, the rotation of the plane is not so damaging to a communication satellite. To a good approximation the long-term motion over many years is a precession about a mean pole lying approximately 7 1/2° from the earth's pole. An initially equatorial synchronous orbit attains a maximum inclination of about 15° after 26.5 years, returning to the equatorial position after 53 years. The changes in eccentricity due to the lunar parallactic term and solar radiation pressure are very small. Author

N64-13363 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE LONG-TERM EVOLUTION OF CIRCULAR NEAR-EQUATORIAL ORBITS AT MEDIUM DISTANCES FROM THE EARTH
G. E. Cook London, Min. of Aviation, Sep. 1963 26 p refs (RAE-TN-SPACE-46)

The long-term evolution of circular near-equatorial orbits is investigated. A linearized theory, valid for orbits at distances between about 3 and 7 earth radii, is given for the combined effects of lunisolar perturbations and the second harmonic in the earth's gravitational potential. Expressions are derived for the variation of the inclination of the orbit to the equator and for the right ascension of the ascending node. Equations are also given for the period of the variations and for the maximum inclination attained by an initially equatorial orbit. Author

N64-13375* Rocketdyne, Canoga Park, Calif.
PROPULSION REQUIREMENTS FOR SOFT LANDING IN EXTRATERRESTRIAL ENVIRONMENTS, VOLUME 2 B Final Report
M. S. Bensky Feb. 1963 246 p refs
(NASA Contract NAS7-124)
(NASA CR-55088; R-5061) OTS: $16.00 ph, $7.43 mf

Landing trajectory concepts applicable to landings on the Moon, Mars, Venus, Mercury, and the Earth were analyzed to define the required propulsive maneuvers and to determine the optimum characteristics of propulsion systems for performance of these maneuvers. Related investigations presented herein were conducted to determine appropriate interplanetary trajectories upon which to base landing analyses and to evaluate takeoff propulsion requirements. Author

N64-13404* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
OPTIMUM INTERPLANETARY RENDEZVOUS TRAJECTORIES WITH POWER-LIMITED VEHICLES
W. G. Melbourne and C. G. Sauer, Jr. 15 Oct. 1962 22 p refs (NASA Contract NAS7-100)
(NASA CR-53030; JPL-TR-32-226(Rev. 1)) OTS: $2.60 ph, $0.80 mf

The optimum-thrust equations for both variable and constant thrust are presented. These thrust programs are used to generate rendezvous trajectories from the Earth to Mars for various flight times and launch dates during the years 1968–71. The manner in which the propulsion requirements vary with flight time and launch date are considered, and a comparison of vehicle performance using the variable- and constant-thrust programs is presented. The optimization of the propulsion system parameters is discussed, and the existence of optimum launch dates is interpreted in terms of certain transversality conditions derivable from the calculus of variations. A brief comparison of the advanced propulsion vehicle and the ballistic vehicle propulsion requirements is made for Earth–Mars rendezvous trajectories. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-12582 Aerospace Corp., El Segundo, Calif. Labs. Div.
A PARAMETRIC ANALYSIS OF LAUNCH VEHICLE RECOVERY TRADE-OFFS
W. N. Rowley 1 Nov. 1963 23 p
(Contract AF 04(695)-269)
(TDR-269(4515-10)-2; SSD-TDR-63-315; AD-425595)

A basic recovery equation is defined, which evaluates the ratio of specific cost or delivery cost on a dollar per pound basis between the two mission modes (i.e., with and without recovery). This recovery equation gives a direct comparison between the two mission modes in dollars per pound of payload delivered, the most meaningful parameter for the purpose of comparison. Three special cases of the basic recovery equation are derived; these special cases are applicable only under restrictive conditions but prove useful in evaluating limits or breakevens. These cases include: (1) economic breakeven point, (2) required recovery efficiency, and (3) maximum recovery gear weight. Author

N64-12613 Oklahoma State U. Research Foundation, Stillwater
A COMBINATION TELEMETRY-TRAJECTORY SYSTEM Scientific Report No. 3
Richard F. Buck Aug. 1963 53 p refs
(Contract AF 19(604)-6648)
(AFCRL-63-778; AD-425648)

The problem of providing with economy, altitude versus time data in conjunction with scientific information from upper air sounding rockets, is reviewed. Objectives of a program meeting the requirements of this problem are outlined, and possible approaches are surveyed in order to select a promising avenue of development. Details of a specific system developed for this purpose, together with historical background for the approach and the general theory behind the method, are presented. The development of the airborne equipment is described in some detail, as is a testing program for evaluation of the system. Records from one of the test flights are reduced and the data obtained compared with radar trajectory data for the same flight, in order to make a direct comparison of the results and an analysis of the success with which the objectives were met. Limitations of the system, both in the electronics and physical system flown, as well as in the methods used in data reduction, are discussed. Author

N64-12713* National Aeronautics and Space Administration, Washington, D.C.
LAUNCH ENVIRONMENT PROFILES FOR SOUNDING ROCKETS AND SPACECRAFT
W. J. Neff and R. A. Montes de Oca (Booz-Allen Appl. Res., Inc.) Jan. 1964 38 p refs
(Contract NAS5-2415)
(NASA TN D-1916) OTS: $1.00

The Launch Phase Simulator must provide several different functions, individually or in combination, for simulating the environmental conditions encountered by the payload of sounding rockets and unmanned spacecraft from liftoff to last stage burnout. A survey has been made of the sounding rockets and spacecraft launch vehicles that NASA is utilizing or will use in the near future, and representative profiles are plotted to show their time history and interrelation of parameters. The following parameters are included in the profiles: acceleration, (longitudinal and lateral), pressure, vibration, acoustics, heating, and spin. From these profiles, an overall envelope of launch environmental parameters has been constructed. Author

N64-12877* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LANDING CHARACTERISTICS OF A REENTRY VEHICLE WITH A PASSIVE LANDING SYSTEM FOR IMPACT ALLEVIATION
Sandy M. Stubbs Washington, NASA, Jan. 1964 25 p refs
(NASA TN D-2035) OTS: $0.75

The passive landing system consisted of a flexible heat shield with a small section of aluminum honeycomb placed between the heat shield and the crew compartment at the point that would be the first to contact the landing surface. The investigations simulated a vertical velocity of 30 fps (full scale), horizontal velocities of 0, 15, 30, 40, and 50 fps (full scale), and landing attitudes ranging from −30° to 20°. The model investigation indicated that stable landings could be made on a concrete surface at horizontal velocities up to about 30 fps, but the stable landing-attitude range at these speeds was small. The aluminum honeycomb bottomed occasionally during landings on concrete. When bottoming did not occur, maximum normal and longitudinal accelerations at the center of gravity of the vehicle were approximately 50g and 30g, respectively. Results indicated stable landings could be made on sand for a wide range of horizontal velocities and negative landing attitudes. Maximum normal and longitudinal accelerations at the center of gravity of the vehicle were approximately 40g and 24g, respectively, for landings on sand. The aluminum honeycomb did not bottom during landings on sand. Author

N64-12937 General Technologies Corp., Alexandria, Va.
INSTRUMENTATION STUDY AND ANALYSIS FOR OBSERVATION OF RE-ENTRY PHENOMENA
H. M. Childers Kirtland AFB, N. Mex., AF Spec. Weapons Center, Jul. 1963 42 p refs
(Contract AF 29(601)-5390)
(AFSWC-TDR 63-58; AD-414163)

The uses of pyrometry, radiometry, spectrophotometry, and photography for determining the temperature of a reentering body are analyzed. It is shown that all but the first of these methods can be used to obtain temperature information on reentering objects that are not ablating. This temperature information is gained from measurements on the shape of the thermal emission curve. Methods for handling the ablating case are discussed. The use of photography for identifying tracer flares that are reentering the earth's atmosphere at high velocities was analyzed and shown to be feasible. How photography, in conjunction with tracer flare reentry experiments, can be used for establishing the validity of mathematical, reentry, burnup models was also analyzed. The various associated difficulties and how they might be overcome are discussed in some detail. Author

N64-12953* RAND Corp., Santa Monica, Calif.
APPLICATION OF DYNAMIC PROGRAMING TO OPTIMIZING THE ORBITAL CONTROL PROCESS OF A 24-HOUR COMMUNICATION SATELLITE
Joy A. Burkhart and Frederick T. Smith Repr. from AIAA Journal, v. 1, no. 11, Nov. 1963 p 2551–2557 refs Presented at the ARS 17th Ann. Meeting and Space Flight Exposition, Los Angeles, 13–18 Nov. 1963
(NASA Contract NASr-21(02))
(RM-3255-NASA (Abridged))

The process is concerned with transferring a satellite from its injected orbit to a hypothetical point moving in a nearby specified reference orbit. The reference orbit considered here is a circular, equatorial orbit with a period of one sidereal day. The optimization of this transfer process is accomplished by applying the techniques of dynamic programing. This essentially involves treating the orbit transfer as a multistage decision process and finding the optimal set of velocity vector increments to be applied to the satellite to accomplish the desired transfer subject to a constraint on the mass of fuel used. The numerical results indicate that the linearity assumptions and the iteration technique involved in the computation of the velocity vector increments are entirely satisfactory. Author

N64-12959* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC LONGITUDINAL CHARACTERISTICS OF THE PROJECT FIRE REENTRY STAGE AFTER REENTRY-PACKAGE SEPARATION AT MACH 28.3 IN HELIUM
Curtis D. Snyder Washington, NASA, Jan. 1964 21 p refs
(NASA TN D-2057) OTS: $0.50

An experimental force and moment investigation has been conducted on a 0.05-scale model of the rocket motor case with adapters attached which will accelerate an instrumented spacecraft to 37,000 fps during a future flight-reentry program. The purpose of this investigation was to obtain data which would aid in determining whether the rocket motor would maintain adequate separation from the reentry package during reentry. The tests were conducted in helium at a Mach number of 28.3 and a Reynolds number of 0.68×10^6 based on rocket-motor diameter. Data were obtained over an angle-of-attack range from 0° to 180°. High-speed Schlieren photography was

employed in an investigation of anomalies in the data at specific angles-of-attack. Discontinuities in the drag and pitching moments are shown to be caused by nearly instantaneous changes in the shock-wave pattern as the attitude of the model was varied. Author

N64-13000 Lowell Technological Inst. Research Foundation, Lowell, Mass.
SUPPORT PROGRAM FOR FIELD MEASUREMENT OF MISSILE PLUMES AND BACKGROUNDS Final Report [1 Oct. 1961-15 Apr. 1963]
Vernon D. Turner, James E. Powers, and Frederick C. Reslow May 1963 75 p
(AF 19(604)-8860; ARPA Order 30-61)
(AFCRL-63-846; AD-422774)

The work performed can be divided in general into two categories—work in support of ground measurement of missile plumes, and laboratory work in support of piggyback instrument flights on missiles and satellites. Measurements were made in the UV, visible, and IR regions of the electromagnetic spectrum. The support consisted of calibration, operation, and modification of measuring equipment, and design and construction of associated electronic equipment. Uncl. Author

N64-13336* Michigan U., Ann Arbor Radiation Lab.
ANALYTICAL STUDIES OF RELATIONSHIPS BETWEEN FAR-FIELD RADIATION PATTERNS AND NEAR-FIELD CURRENT DISTRIBUTIONS AND SURFACE CONFIGURATION OF THE EFFECTS OF SMALL-VEHICLE (FEW WAVELENGTHS) ON ANTENNA PERFORMANCE First-Semi-Annual Progress Report, 1 May-1 Nov. 1963
T. B. A. Senior 20 Nov. 1963 6 p
(NASA Grant NsG-444)
(NASA CR-55191; Rept. 5780-1-T)

The problem of designing antennas for space vehicle application in order to obtain omnidirectional coverage is discussed. The methods investigated employed many radiators around the circumference of the space vehicle. The difficulty inherent in this type of method is discussed. R.T.K.

N64-13402 * Battelle Memorial Inst., Columbus, Ohio
SPACE-VEHICLE STABILIZED-PLATFORM GIMBAL-SYSTEM-WEIGHT-REDUCTION STUDY. PHASE I: DESIGN OF RING GIMBALS Summary Report [Jul. 1-Dec. 28, 1962]
J. E. Sorenson, J. C. Gerdeen, L. E. Hulbert, T. J. Atterbury, and G. M. Mc Clure 28 Dec. 1962 187 p refs
(NASA Contract NAS8-5101)
(NASA CR-55263) OTS: $13.00 ph, $5.81 mf

This report describes the analysis and design synthesis of the supporting structure of a stabilized platform, the primary objective being to minimize the weight of the supporting gimbals. The analysis resulted in an overall weight reduction of 24.53 pounds (calculated) in the supporting structure (original weight 54.41 pounds) with only a 16 percent reduction (calculated) in the lowest system response frequency. Considered in the analysis were stresses and deflections for an 8-g linear acceleration. The calculations were carried out with the aid of a Bendix G-20 digital computer. A generalized stiffness-matrix computer program was written for this problem and was used to calculate the displacements for various loading conditions. The stresses were calculated by means of an additional program used in conjunction with the stiffness-matrix program. The redesigned structure was then analyzed for response frequencies. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

No abstracts in this issue.

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-12891 Joint Publications Research Service, Washington, D.C.
FLIGHTS OF SPACE VEHICLES VOSTOK-5 AND VOSTOK-6
V. I. Yazdovskiy and V. G. Denisov *In its* Outer Space Explorations 4 Dec. 1963 p 23-41 (See N64-12889 04-01)

The main result of the simultaneous flight made by the two Soviet cosmonauts in Vostok-5 and Vostok-6 is the confirmation of the fact that a specially chosen and trained human being (man or woman) withstands flight in a normal manner during the various phases, and retains his capacity to work during a period of 5 days under conditions of weightlessness. The ability of a cosmonaut to control a space vehicle is also discussed. R.T.K.

N64-12957* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF DISSIMILAR SATELLITE APPENDAGES DURING ERECTION
Richard W. Forsythe Washington, NASA Jan. 1964 18 p refs
(NASA TM X-938) OTS: $0.50

By using the Lagrangian formulation of dynamics, equations of motion are developed to describe the deployment process of unlike swinging appendages erecting simultaneously on a spinning satellite. With the Ariel I International Ionosphere Satellite (1962 α1) used as the example, an analog computer solution for the variables involved in the erection of the solar paddles and the spin stabilization booms is shown. Author

N64-13112 Toronto U. (Canada)
ATTITUDE STABILITY OF ARTICULATED GRAVITY-ORIENTED SATELLITES. PART II — LATERAL MOTION
H. Maeda (Kyoto U.) Jun. 1963 49 p refs
(AF Grant AFOSR-222-63)
(UTIA-93; AD-423941)

By a procedure similar in principle to that for the longitudinal equations of motion, the lateral equations of a specific compound satellite system were derived. As a result of linearization for small perturbations, the effect of orbit ellipticity vanishes in the lateral motion. Both the general

case, i.e., with hinged yaw-stabilizers, and a simpler case, i.e., with fixed yaw-stabilizers, are discussed. The latter is considered to be better from a practical standpoint. After calculating numerical examples, the configuration was found to provide damping of the lateral motion to 1/2 amplitude in about 0.28 orbits, which is a little better than was previously found for the longitudinal modes. Author

N64-13169* National Aeronautics and Space Administration, Washington, D.C.
A SOLUTION IN SEARCH OF A PROBLEM
Morris Tepper Repr. from Bull. Am. Meteorol. Soc., v. 44, no. 9, Sep. 1963 p 543–548 Presented at the 3d Natl. Conf. on the Peaceful Uses of Space, Chicago, 3 May 1963
(NASA RP-96)

A brief review is given of the meteorological satellite programs. Included are short discussions concerning both the TIROS and the Nimbus satellite families in their technological development periods and their scientific experimentation programs. Concern is shown for the fact that the data output from meteorological satellites is not immediately adaptable to the current stated problems being investigated by the research meteorologist. Two ways are proposed through which the data output could be made to correspond more directly to the research meteorologist's requirements. The first is to have the researcher make the requirements more flexible, and use whatever data are available, and the second is to control the nature of the data output. C.L.W.

N64-13180* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE MARINER R PROJECT: VOLUME 2: SUPPLEMENTARY DOCUMENTATION. Progress Report, Sep. 1, 1962–Jan. 3, 1963
1 Jul. 1963 269 p
(Contract NAS7-100)
(NASA CR-55205; JPL-TR-32-422, Vol. 2) OTS: $17.00 ph, $8.27 mf

Supplements containing the following are presented: (1) the final distribution of drawing lists covering the flight hardware and ground support equipment for Mariner R 1962 and Mariner 1964; for accuracy and consistency, the tabulations are presented as photographic reproductions of the actual documents in JPL design-group files; (2) numerical listings of all Mariner specifications published before January 1, 1963; the specifications are grouped into the following categories: (a) inclusive Mariner specifications, (b) Mariner R design specifications, (c) Mariner R detail specifications, (d) Mariner R test specifications, (e) Mariner R general specifications, and (f) Mariner R process specifications; (3) a listing of components designated as flight equipment for Mariner R 1964, prior to the cancellation of the Mariner R Project; (4) a summary of Mariner R design changes which were effected or approved by means of formal documents known as Engineering Change Requirements; (5) a summary of Mariner R-3 design-evaluations tests; and (6) a summary of failure reports for Mariners 1, 2, and R-3. I.v.L.

N64-13202* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH ANOTHER RELAY COMMUNICATIONS SATELLITE News Release 64-9
19 Jan. 1963 16 p
Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

According to NASA, a second Relay communications satellite will be launched aboard a Delta rocket. The satellite will be boosted into an orbit of about 4600 miles apogee and 1325 miles perigee. It will orbit the earth every 3 hours and 15 minutes while moving in a path inclined 47° to the Equator. The new Relay has no automatic cutoff device. It has N-on-P (negative on positive) solar cells which give greater resistance to radiation than the P-on-N cells in the previous Relay. Other component changes are different transistors for the voltage regulator; electrically operated mechanical switches to assure ability to turn off transmitting equipment; relocated temperature-measuring devices; and a new traveling-wave tube. This tube transmits the television or radio signal through the spacecraft antenna to the ground. Relay II will be in much better mutual visibility in relation to Europe, South America, and Asia than Relay I. The newest Relay, like Relay I, will transmit one-way wideband communications (television, 300 one-way voice channels or highspeed data) or two-way narrowband communications (12 two-way telephone conversations or teletype, photofacsimile and data). I.v.L.

N64-13203* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH SECOND ECHO COMMUNICATIONS SATELLITE News Release 64-11
21 Jan. 1963 18 p
Available from NASA. Offices of Scientific and Technical Information, Wash., D.C.

NASA has announced that another Echo passive communications satellite, Echo II, will be launched no earlier than January 23, 1964. The 135-foot-diameter balloon will be injected into a 800-mile-high circular, near-polar orbit at an inclination of 82° by a Thor-Agena launch vehicle. The spacecraft is designed to be rigid enough to withstand the stresses of space and remain spherical without collapsing after the inflating gas has leaked out. If the spacecraft remains spherical, it will provide a large and unchanging reflecting surface with long lifetime and multiple access. With the inflation system to be tested on this flight, the 35-lb-sphere (without payload) will utilize a controlled inflating method which will take about 90 minutes to complete. This will allow the satellite to hold much higher pressures, and with slower inflation, there will not be as much chance as previously for putting too much stress, too fast, on the thin Mylar skin. I.v.L.

N64-13263* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-23, VOLUME 6, FOR THE PERIOD JULY 1, 1963 TO SEPTEMBER 30, 1963. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES
31 Oct. 1963 89 p refs
(NASA Contract NAS7-100)
(NASA CR-53009; JPL-SPS-37-23, Vol. 6) OTS: $8.10 ph, $2.87 mf

Progress is reported as follows: *Lunar Program*—Ranger Block III (Rangers 6 through 9) design is complete, and proof-test-model testing is continuing; Surveyor spacecraft and space-flight operations are being studied; *Planetary-Interplanetary Program*—the Mariner Mars 1964 mission spacecraft proof-test-model is approaching the construction stage; testing of component systems is continuing; and mission analyses for Voyager-type spacecraft are being evaluated; *Deep Space Instrumentation Facility*—communications research and development of new components is maintaining state-of-the-art capability; *Operational and Test Facilities*—the Space Flight Operations Facility building is nearing completion and installation and checkout of equipment is being scheduled; an additional space simulator is being designed for the Environmental Test Laboratory; and operational support equipment being

developed includes a standard chassis for commercial components and a standard electronics console for use with it; *Space Sciences*—space instruments and instrument systems being developed include an automatic scale-factor device for use with electrometers, planetary interferometers, microwave radiometers, motors for spacecraft tape recorders, radiation detectors, and biological-sample collectors. M.P.G.

N64-13291* National Aeronautics and Space Administration, Washington, D.C.
FOUR MORE CANADIAN SATELLITES FROM US-CANADA AGREEMENT News Release 64-6
14 Jan. 1964 10 p refs
Available from NASA. Office of Scientific and Technical Information, D.C.

According to NASA and the Canadian Defence Research Board an agreement has been made for a joint multisatellite upper atmosphere research program. Designated ISIS (International Satellites for Ionospheric Studies), the new program will involve satellites called Alouette B and ISIS A, B, and C. They will be launched at intervals between 1965 and 1970. Under the terms of the agreement for joint research in and above the ionosphere, Canada's Defence Research Board will design, construct, and test the spacecraft, provide the basic experiment (the topside sounder), and operate at least one ground station capable of supplying data on spacecraft operation. NASA's primary obligations include providing four launch vehicles, placing the spacecraft in orbit, providing and launching up to five sounding rockets for testing components and subsystems, and determining the compatibility of experiments. R.T.K.

N64-13340 Allied Research Associates, Inc., Concord, Mass.
NIMBUS ATTITUDE DETERMINATION SUBSYSTEM Final Report
R. Bartlett, C. Dean and J. Greaves 7 Jun. 1963 98 p
(Contract Cwb-10489)
(ARA-9207-03-1)

This report details the operational procedures and equipment requirements of a subsystem for determination of Nimbus satellite attitude by photogrammetric techniques. Coordinate measurements of landmarks and common points in adjacent triplets appearing in kinescope-generated cloud cover photographs are measured on a film reader whose output feeds a digital computer for immediate computation of attitude. This computer is programed to test the film reader data and communicate with the film reader operator if omissions or mistakes are apparent. A second function of the subsystem is the determination of electronic distortion occurring in the cloud cover photos by measurement of the fiducial marks which have been placed on the camera system vidicons. Author

N64-13392* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOL. 3, NO. 24
15 Dec. 1963 24 p
(NASA TM X-51375; NASA X-533-63-1) OTS: $2.60 ph, $0.92 mf

The following information is presented for objects in orbit: code name, source (U.S. or U.S.S.R.), launch date, nodal period, inclination, apogee, perigee, and transmitting frequency. Information presented for decayed objects includes: code name, source, launch date, and decay date. P.V.E.

N64-13401* Grumman Aircraft Engineering Corp., Bethpage, N.Y.
WATER IMPACT OF THE MERCURY CAPSULE CORRELATION OF ANALYSIS WITH NASA TESTS
J. D. Rosenbaum and W. R. Jensen Dec. 1962 13 p refs
(Sponsored by NASA)
(NASA CR-55251; ADN-02-08-62.1) OTS: $1.60 ph, $0.80 mf

The purpose of this note is to compare analytical values of vehicle accelerations and motions with corresponding experimental data for Mercury space capsule water landings. Although the comparison is limited to still water, an indication of the validity of the method in obtaining a first approximation to actual water landing effects is evident. Author

N64-13407* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-16, VOLUME VI FOR THE PERIOD MAY 1, 1962-AUGUST 1, 1962. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES
31 Aug. 1962 79 p refs
(NASA Contract NAS7-100)
(NASA CR-53036; JPL-SPS-37-16, Vol. 6) OTS: $7.60 ph, $2.57 mf

Activities in the following areas are summarized: (1) the lunar program—Ranger project and Surveyor project; (2) the planetary–interplanetary program—Mariner project and Voyager project; (3) the Deep Space Instrumentation Facility (DSIF); and (4) space sciences—lunar studies, planetary studies, and solar and interplanetary studies. P.V.E.

N64-13409* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-21, VOLUME VI FOR THE PERIOD MARCH 1, 1963 TO MAY 31, 1963. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES
30 Jun. 1963 84 p refs
(NASA Contract NAS7-100)
(NASA CR-53039; JPL-SPS-37-21, Vol. 6) OTS: $8.10 ph, $2.72 mf

Activities in the following areas are summarized: (1) the lunar program—Ranger project and Surveyor project; (2) the planetary–interplanetary program—Mariner project and Voyager project; (3) the Deep Space Instrumentation Facility—communications research, development, and facilities; (4) operational and test facilities—space flight operations facility and test and support equipment; and (5) space sciences—space instruments development, space instruments systems, and lunar and planetary studies. P.V.E.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-12416 General American Transportation Corp., Niles, Ill. MRD Div.
AIR BLAST LOAD REDUCTION ON ABOVEGROUND STRUCTURES

Fred C. Finlayson *In* Defense Dept. Shock, Vibration, and Assoc. Environments, Pt. 2: Protective Construct. Aug. 1963 p 151–168 refs (See N64-12407 04-01)

This paper describes the feasibility of using aerodynamic spoilers or deep pits, or both, to reduce air blast loads on aboveground entrances to hardened aircraft shelters. Data were obtained on two-dimensional models in a shock tube where overpressures of 400 psi were simulated. Impulse reductions of from 35 to 78 percent were shown to be obtainable with practical aerodynamic spoilers. Author

N64-12609 Mellon Inst., Pittsburgh, Pa.
A STUDY OF THE BEHAVIOR OF SMALL PRESSURE VESSELS UNDER BIAXIAL STRESS CONDITIONS AND IN THE PRESENCE OF SURFACE CRACKS Final Report [Mar. 1962–30 Jun. 1963]
G. K. Bhat 25Jun. 1963 179 p
(Contract Nonr-3764(00) (X))
(NRL-TM-242; AD-425729)

Results are presented of a study of the behavior of small, seamless, thin-wall pressure vessels of several ultrahigh-strength steels tested under biaxial stress conditions, and also in the presence of surface fatigue cracks of predetermined sizes inserted on the exterior sidewall of the vessels, perpendicular to the hoop direction. The steels included are AISI 4130, AISI 4340, AMS 6434, MX-2, X-200, 300M, D-6AC, Rocoloy 270, H-11, 18Ni 7Co 5Mo (250 Ksi), and 18Ni 9Co 5Mo (300 Ksi). It has been concluded from this study that flaws affect the performance of the medium carbon (0.30 to 0.35 percent) constructional steels, AISI 4130, AMS 6434, MX-2, to a lesser degree than higher carbon (0.40% and higher) and higher alloy constructional steels. Under biaxial stress conditions cracks have a more potent influence in reducing the stress capability than under uniaxial stress for all materials, except the Maraging 18Ni steels which exhibited low crack sensitivity. Author

N64-12612 Douglas Aircraft Co., Inc., Long Beach, Calif.
STRUCTURAL DESIGN FOR ACOUSTIC FATIGUE Technical Report [11 Jun. 1962–30 Sep. 1963]
G. E. Anderson Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab. Oct. 1963 122 p refs
(Contract AF 33(657)-8217)
(ASD-TDR-63-820; LB-31354; AD-425406)

The results of acoustic testing on several types of aircraft structure are compiled and are used to produce acoustic fatigue design charts. Theo theory on which the charts are based is explained. A method of converting constant amplitude S-N data to random data is presented, as is a method of converting discrete frequency test results to equivalent random data. Test results from various other companies test facilities are compared. Author

N64-12624 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON WING FLUTTER IN A GAS FLOW
D. N. Gorelov 28 Oct. 1963 10 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekhan. i Astron., v. 1, no. 1, 1957 p 192–196
(FTD-TT-63-738/1+2; AD-424867)

A method is proposed to study wing flutter by computation of the work of the forces acting on the wing during the period of vibrations. Using this method, it is assumed that the wing can execute steady torsional bending waves with quite small amplitudes. The sweep of the wing in this case is considered as being infinitely great. C.L.W.

N64-12631 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
VIBRATIONS OF ELASTIC STRUCTURES OF CIRCULAR CYLINDRICAL FORM SITUATED IN A SUPERSONIC FLUID FLOW
Liviu Librescu 1 Nov. 1963 21 p refs Transl. into ENGLISH from Studii si Cercetari de Mecanica Aplicata (Bucharest), no. 1, 1961 p 139–156
(FTD-FF-63-744/1+2+3; AD-425509)

The problem of vibrations of thin elastic structures of cylindrical form, constructed by arbitrary superposition of m orthotropic layers was studied. The structures were considered situated in an ideal, supersonic fluid flow, a flow that was regarded as potential and isentropic, with a free-stream velocity U and a vector parallel to the axis of the cylindrical structures. Both the elasticity equations of these structures and the equations of hydrodynamics were considered in order to investigate the vibration problem. C.L.W.

N64-12632 Air Force Systems Command, Wright-Patterson AFB, Ohio
MEASUREMENT OF THE VIBRATIONS OF THIN SHELL MODELS AND THREE-DIMENSIONAL MODELS OF BAR SYSTEMS BY MEANS OF AN ELECTRONIC APPARATUS
Alexander Lisowski 6 Nov. 1963 11 p Transl. into ENGLISH from Studii Si Cercetari De Mecanica Aplicata (Bucharest), no. 2, 1962 p 433–440
(FTD-TT-63-735/1+2+3+4; AD-425494)

A dimensional formula pertaining to the natural vibrations of thin shell models is derived, and a special apparatus for the measurement of static and dynamic displacements, by means of a capacitive transducer, is described. The dimensional formula is $n'/n'' = L''/L' \cdot \sqrt{E'/E'' \cdot \mu''/\mu'}$ where n is the frequency of the natural vibrations, E is the modulus of elasticity, and μ is the mass resulting from a source unit of the "covering". The prime values refer to the first object, and those double-primed refer to the second object. The derivation of the formula was based on the hypothesis of the dimensional analysis and its fundamental law (the π law) as established by E. Buckingham. Assuming that there is a geometrical similarity between the constructed model and the real object, its dimensions can be determined by a single value L. An analysis of this formula shows that the frequencies of vibration of two different models built of the same material and with similar shapes are inversely proportional to the linear values of the models. The measurement apparatus consists of the following three main parts: (1) a system of capacitive transducers (two separate systems); (2) a vacuum-tube voltameter with output adapted to an oscillograph; and (3) a power unit (220 volt ac). I.v.L.

N64-12638 IIT Research Inst., Chicago, Ill.
TWO-DIMENSIONAL DYNAMIC STRESS ANALYSIS IN A NONELASTIC MATERIAL Final Report [15 Feb. 1962–14 Jun. 1963]
I. M. Daniel Kirtland AFB, N. Mex., Res. Tech. Div., Nov. 1963 160 p refs
(Contract AF 29(601)-5109)
(RTD-TDR-63-3059; AD-424401)

This program is one of a series of related programs whose ultimate objective is to provide technical information for the design of underground structures capable of withstanding the extremely high pressures generated by nuclear explosions. The specific objective of this program was to develop materials, methods, and techniques for two-dimensional experimental stress analysis in viscoelastic polymeric materials. A great number of polymeric photoviscoelastic materials were investigated, and one was selected as suitable for the program. This

was plasticized polyvinyl chloride, a low modulus, transparent and birefringent viscoelastic material. Mechanical and optical properties under creep and relaxation conditions were determined. Dynamic mechanical and optical properties were determined by means of force sinusoidal oscillations over a wide range of frequencies. Photoviscoelastic and moire methods were developed for solving two-dimensional dynamic stress analysis problems, and their application is demonstrated in the case of a strut subjected to a falling weight load. Author

N64-12711 Massachusetts Inst. of Tech., Cambridge Aeroelastic and Structures Research Lab.
THE FLUTTER OF MULTI-BAY PANELS AT HIGH SUPERSONIC SPEEDS
Earl Dowell Aug. 1963 121 p refs
(Contract AF AFOSR-62-363)
(AFOSR 5327; ASRL-TR-112-1; AD-423929)

The flutter of two-dimensional panels of finite and infinite length on multiple simple supports in the streamwise direction has been investigated theoretically under the assumption that the system is adequately described by classical small deflection plate theory and quasisteady, supersonic aerodynamic theory. No further physical and/or mathematical approximations are made, and a solution is effected by the method employed by Hedgepeth, Houbolt, and Movchan for the one bay (two supports) configuration. Specific numerical results are obtained for the one, two, three, four, five and six bay cases, as well as the infinite bay case with motion of arbitrary spatial periodicity. Author

N64-12818 Harvard U., Cambridge, Mass. Div. of Engineering and Applied Physics
THE EFFECT OF A STRINGER ON THE STRESS IN A CRACKED SHEET
Robert Greif and J. Lyell Sanders, Jr., Jun. 1963 42 p refs
(Contract Nonr-1866(02))
(Tech. Rept. 17; AD-425873)

An infinite stringer is assumed to be continuously attached to a sheet along a line perpendicular to a finite crack. At a great distance from the crack, the sheet is under a uniform tensile stress parallel to the stringer. The plane stress solution for this problem is carried out by using the complex variable approach of Muskhelishvili to derive an integral equation which is then solved numerically on the IBM 7090 computer. In particular, the effect of the stringer on the strength of the stress singularity at the crack tip, and the maximum load concentration factor in the stringer are found. Author

N64-12821 Columbia U., New York, N.Y.
FINITE PLANE DEFORMATION OF A HOLLOW CYLINDER
M. P. Bieniek and M. Shinozuka Sep. 1963 20 p refs
(Contract Nonr 266(78))
(Tech. Rept. 20; CU-20-63-ONR-266(78) CE; AD-423298)

A simple numerical method is developed to solve the problem of large deformation of a case-bonded hollow cylinder. The material of the cylinder is assumed to be a nonlinear elastic solid whose mechanical behavior is described by an arbitrary strain energy function. Author

N64-12833 Aerospace Corp., El Segundo, Calif. Labs. Div.
STRESS CONCENTRATION FACTORS FOR SEMIELLIPTICAL NOTCHES IN BEAMS UNDER PURE BENDING
C. H. Tsao, A. Ching, and S. Okubo 25 Oct. 1963 36 p ref
(Contract AF 04(695)-169)
(TDR-169(3230-11)TN-16; SSD-TDR-63-241; AD-417484)

Elliptical notches in rectangular beams under pure bending are examined photoelastically. Stress concentration factors due to a single elliptical notch are obtained for wide ranges of 2a/h and d/h, where 2a, d, and h are the width of notch, depth of notch, and depth of beam, respectively. In particular, the geometries of the optimum elliptical notches producing the least stress concentrations are obtained. Almost the whole elliptical boundary of these notches are stressed to the same peak, which indicates that these notches will probably produce the least stress concentrations among all notches, elliptical or nonelliptical. Stresses and the stress concentration factors at the bottom of the beam opposite the notch are also obtained. These stresses, though smaller in magnitude, are of an opposite sign to the peak stress at the notch. For brittle materials, a smaller tensile stress may be more critical than a large compressive stress; therefore, these stress concentration factors are also given. Author

N64-12848* Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF THE INITIAL FUNCTIONS METHOD TO DETERMINE NATURAL OSCILLATION FREQUENCIES OF RECTANGULAR PLATES
N. O. Ventsel' and V. A. Agar'ov 13 Sep. 1963 9 p refs
Transl. into ENGLISH of an article from Akad. Nauk Ukr. RSR. Dopovidi, no. 11, 1960 p 1485–1491
(FTD-TT-63-740/1+2; AD-424472)

Expressions are given for a general solution at arbitrary conditions along the edges of a rectangular plate for symmetrical, skew-symmetrical, and nonsymmetrical oscillations. J.E.T.

N64-12922 Polytechnic Inst. of Brooklyn, Freeport, N.Y.
CREEP IN THE PRESENCE OF A CONCENTRATED FORCE AT A POINT
B. Venkatraman Nov. 1963 15 p For Presentation at Conf. on Thermal Loading and Creep in Structures and Components, Inst. of Mech. Engr., London, May 1964
(Grant AF-AFOSR-419-63; and Contract Nonr-839(23))
(PIBAL-674; AD-423206)

The initial investigation in the present paper concerns itself with the problem of creep in an infinitely large plate with a concentrated force taken as a line load along the thickness of the straight boundary. Closed form solutions for stresses and deflections are obtained for this problem on the basis of a nonlinear creep law. These results are then used to obtain solutions to the problems of a wedge, with a concentrated force at its apex, and a V-notch with a concentrated force at its base. Uncl. Author

N64-12938 Air Force Missile Development Center, Holloman AFB, N. Mex.
RIGID BODY VIBRATIONS OF HIGH-SPEED SLEDS
Paul N. Sonnenburg Mar. 1963 57 p refs
(MDC-TDR-63-1; AD-401400)

A general study was made of rigid body vibration of a resiliently supported structure from established equations of motion in six degrees of freedom. Formulas were derived from the solution of these equations whereby the inertia and elastic constants could be calculated for an existing structure by exciting the natural frequencies and taking certain displacement measurements. The formulas were applied to a practical problem to show the validity of the theory and to illustrate a test method which, if refined, may rapidly yield accurate values of the inertia and elastic constants of an existing structure. The research was conducted to provide an understanding of

the causes of low frequency vibration of rocket propelled sled structures. The theory is applicable to any problem where the inertia and elastic constants of a structure must be determined. Author

N64-12978 Polytechnic Inst. of Brooklyn, N.Y.
A FURTHER NOTE ON THE CREEP BEHAVIOR OF CIRCULAR PLATES
B. Venkatraman and P. G. Hodge, Jr. Nov. 1963 15 p refs
(Contract Nonr-839(23))
(PIBAL-677; AD-423078)

The present note is an extension of a previous investigation of the creep behavior of circular plates. The range of validity of the solutions given in the reference is examined, and it is shown that, although in some cases the results for the simply supported plates can be obtained from those of the clamped plates by a suitable change of scale factors, this is not always possible. Author

N64-12994 Rohm and Haas Co., Huntsville, Ala.
ENGINEERING RESEARCH Quarterly Progress Report, 15 Dec. 1962-15 Mar. 1963
John J. Brisbane and W. H. Groetzinger, III 15 Nov. 1963 121 p refs
(Contract DA-01-021-ORD-11878)
(P-63-6; AD-424650)

A data reduction method was developed which corrects for finite loading times in viscoelastic stress relaxation and creep tests which are defined mathematically in terms of zero loading times. This method, which requires the use of a controlled loading, is demonstrated for a linear strain rise in a tensile stress relaxation test. Results are given for other types of strain application. A quick, easy method of fitting a set of experimental stress relaxation data with a series of exponential terms was demonstrated. A FORTRAN program has been written for the simultaneous solution of $X(1 \leq X \leq 7)$ diffusion processes (of which heat conduction is a special case) coupled to $Y(0 \leq Y \leq 7)$ chemical reactions in the unsteady state and in a generalized one-dimensional single-layer geometry. The program and its operation are described in detail. A printout of the program in FORTRAN statements is provided. Author

N64-13033 Stanford U., Calif.
BUCKLING TESTS ON THIN CIRCULAR CYLINDRICAL SHELLS HEATED ALONG AN AXIAL STRIP
Bernard Ross, J. Mayers and A. Jaworski Jun. 1963 72 p refs
(Contract AF 49(638)-223; Grants AFOSR-62-146; AFOSR-138-63
(SUDAER-163; AD-424060)

Calculations of critical temperature based upon the small deflection theory for thin circular cylindrical shells are included, and a comparison is made between theoretical and experimental results. Cylinders heated along axial strips of given widths have a theoretically predicted behavior which corresponds reasonably well to the behavior obtained by experiment. Curves are included, showing the variation of critical temperature with respect to heated axial strip width. Author

N64-13071 Southampton U. (Gt. Brit.)
PART 2: RESPONSE OF PANELS TO RANDOM PRESSURE FIELDS
In its Wall Pressure Fluctuations in Boundary Layer Flow and Response of Simple Struct. to Random Pressure Fields Jul. 1963 80 p refs

Theoretical and experimental investigations of the response of simple panels to various forms of random excitation are discussed. Particular reference is made to the excitation produced by the pressure fluctuations in a turbulent boundary layer. Areas covered include: (1) a comparison between panel response to acoustic excitation and response to boundary-layer pressure fluctuations; (2) the effect of boundary-layer characteristics on panel vibration; and (3) the effect of boundary-layer thickness on panel response. I.v.L.

N64-13223* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMMENTS ON "A NOTE ON THE CLASSICAL BUCKLING LOAD OF CIRCULAR CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION"
R. W. Leonard Repr. from AIAA Journal, 1963 1 p refs
(NASA RP-95)

R. C. Tennyson, in his work on the classical buckling load of circular cylindrical shells under axial compression, claims to have attained experimental buckling loads within 10% of the classical load and, on this basis, concludes that the classical load is attainable if the cylinder is free of initial imperfections. However, it is evident from the different slopes of the theoretical and experimental curves of Tennyson that the true extensional stiffness of the experimental cylinder material is somewhat greater than that used in the calculation of the classical load. If the experimental result is compared with the correct classical load for the cylinder specimen, the discrepancy between theory and experiment is more than doubled to 16%. In addition, Tennyson's cylinder specimen has a relatively low ratio of radius to thickness ($R/t = 154$), and it is well known that buckling loads as high as Tennyson's are attainable for such cylinders without unusual efforts to eliminate shape imperfections. Thus, Tennyson's result does not constitute new or unique evidence of the importance of imperfections and does not warrant his strong conclusion. I.v.L.

N64-13241 Republic Aviation Corp., Farmingdale, N.Y.
EVALUATION OF HIGH-STRENGTH LIGHTWEIGHT LAMINATED PRESSURE VESSELS OF LAP-JOINT CONSTRUCTION Fifth Quarterly Progress Report, 1 Jan.-31 Mar. 1963
G. Citrin Watertown, Mass., Watertown Arsenal, 10 Apr. 1963 59 p
(Contract DA-30-069-ORD-3440)
(WAL-TR-766.2/3-4; RAC-1313, 244-3005; AD-408278)

Five pressure vessels were assembled and tested to failure. They were fabricated of three nominal thicknesses of material, 0.025-, 0.040-, and 0.064-in.-thick maraging steel. An analysis of the results of these tests indicated the feasibility of the lightweight laminated pressure vessels of lapjoint design, and showed the difficulty of demonstrating a reproducible confidence level with reusable header closures that had sustained some deformation during hydrostatic tests to high-energy levels. Author

N64-13254 Rohn and Haas Co., Huntsville, Ala.
QUARTERLY PROGRESS REPORT ON ENGINEERING RESEARCH
John J. Brisbane and Thomas L. Cost 29 Jul. 1963 97 p refs
(Contract DA-01-021-ORD-11878)
(P-63-13; AD-413968) OTS: $8.60

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34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads.

N64-13255 Rohn and Haas Co., Huntsville, Ala.
STRESSES, STRAINS, AND DISPLACEMENTS IN THE "POKER CHIP" TEST SPECIMEN
John J. Brisbane *In its* Quarterly Progress Report on Engineering Research 29 Jul. 1963 p 1–26 (See N64-13254 04-33) OTS: $8.60

The stresses, strains, and displacements in the "poker chip" test specimen were found using a finite difference technique which was developed and reported previously. The results are presented in dimensionless form as functions of two variables: the ratio of diameter to thickness and Poisson's ratio. A bonded end tensile specimen was also analyzed with the same procedure, and the deviation of the stress distribution from uniaxial tension which occurs near the bonded ends was illustrated. Author

N64-13256 Rohn and Haas Co., Huntsville, Ala.
APPROXIMATE LAPLACE TRANSFORM INVERSION TECHNIQUES IN VISCOELASTIC STRESS ANALYSIS
Thomas L. Cost *In its* Quarterly Progress Report on Engineering Research 29 Jul. 1963 p 27–92 refs (See N64-13254 04-33) OTS: $8.60

An investigation was made of approximate methods for inverting Laplace transforms which occur in viscoelastic stress analysis. Several other techniques based on orthogonal function theory were also examined. In these methods, the desired time dependent function is expressed in terms of a series of orthogonal functions. The special cases of Widder's formula and the orthogonal function methods were examined in regard to accuracy, applicability, and computational effort involved. Widder's general inversion formula was shown to be applicable mainly to transformed functions possessing analytical expressions and gives superior accuracy for these cases. The methods involving orthogonal functions were found to be ideally suited to the inversion of transformed functions known only at discrete values of the transform parameter. Author

N64-13372 Du Pont de Nemours (E.I.) and Co., Aiken, S.C.
STATIC AND IMPACT TESTS ON 15-TON CASK FOR SHIPPING IRRADIATED FUEL
W. I. Thisell and J. W. Langhaar Aug. 1963 155 p
(Contract AT(07-2)-1)
(DP-843) OTS: $2.75

This report covers the results of nondestructive static and destructive dynamic tests on a full-size 15-ton lead-shielded steel cask used for shipping irradiated atomic reactor fuels. Testing of the 15-ton cask was undertaken to provide direct observation of the structural integrity of a fairly representative cask under impact conditions, and to provide a comparison between full-scale results and model results. Static compression tests were conducted with the cask in eight different attitudes to determine the direction of least resistance and provide data that might be correlated with that of the drop tests. Five drop tests with impact velocities of 10 to 30 mph were performed. Deceleration and dynamic strain data were recorded. Author

N64-13045 Boeing Co., Seattle, Wash.
FURTHER DEVELOPMENT AND APPLICATIONS OF THE STIFFNESS METHOD
M. J. Turner, H. C. Martin (Washington U., Seattle), and R. C. Weikel [1962] 125 p refs Paper Presented at a Meeting of the AGARD Struc. and Mater. Panel, Paris, 6 Jul. 1962

Discussed are the choice and use of axes systems, transformation matrices, procedure for handling mixed boundary value problems, and details associated with imposing constraints on certain classes of problems. The calculation of stresses is presented in detail. It is shown that stress determination should be based either on averaging results obtained from the so-called stress matrix, or on a procedure employing nodal forces. Attention is given to problems possessing geometric nonlinearity. A new derivation is given for the triangular element undergoing in-plane deformation in the presence of initial stresses. Examples illustrating the theory include several stability (eigenvalue) calculations, plus the analysis of a heated sweptback wing. The direct stiffness method is applied to the structural and vibration analysis of an actual helicopter structure. Author

N64-13181 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
A NOTE ON THE FAILURE MODES OF FILAMENT REINFORCED MATERIALS INCLUDING THE INFLUENCE OF CONSTITUENT GEOMETRY AND PROPERTIES
B. Walter Rosen [1964] 29 p refs For presentation at Meeting of Soc. of Plastics Ind., Chicago, 4–6 Feb. 1964
(NASA Contract NASw-817)
(NASA CR-55192) OTS: $2.60 ph, $1.07 mf

Filament reinforced plate and shell structure are studied to define the relationship of constituent geometry and properties to the elastic constants of laminates, the buckling stress of filament wound cylindrical shells, and the lamina stresses in such shells. The results indicate the nature of desirable constituent property changes to achieve improved structural composites. Author

N64-13193 California U., Livermore. Lawrence Radiation Lab.
DEFLECTIONS AND STRESSES IN HEMISPHERICAL LIGHTWEIGHT CELLULAR SUPPORT STRUCTURE WITH FLEXIBLE SUPPORTING SHELL
J. Penzien and G. L. Sheldon Sep. 1963 64 p
(Contract W-7405-eng-48)
(UCRL-7473) OTS: $1.50

A spherical component is frequently supported by a hemispherical lightweight cellular core which is in turn supported by a flexible elastic support shell. This report gives design information on computing the normal and shear stresses in the core as well as circumferential and meridional stresses in the flexible support shell. A set of graphs is given showing the ratio of these stresses for the case of a flexible support shell to the corresponding maximum stress for the case of a rigid support shell, plotted against the meridional angular coordinate of the hemisphere. Two dimensionless geometrical

and material parameters appear as variables in these graphs. A second set of graphs to be used for obtaining displacements of the flexible shell with respect to the supported sphere are also plotted in this manner. Author

N64-13248 McDonnell Aircraft Corp., St. Louis, Mo.
EFFECT OF INTERNAL PRESSURE UPON HOLLOW HELICAL SPRINGS [Final Report]
C. D. Christiansen 10 Dec. 1963 9 p
(Contract AF 33(657)-11215)
(A238; AD-425050)

The results of tests conducted upon 6061-T6 hollow aluminum helical springs, both extension and compression, indicate that only minor variations of the spring constant, free length, or mean coil diameter result from internal pressurization. Author

N64-13276* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THERMOELASTIC ANALYSIS OF A PARABOLIC SHELL
G. S. Stern 1 Aug. 1963 17 p refs
(NASA Contract NAS7-100)
(NASA CR-53007; JPL-TR-32-479) OTS: $1.60 ph, $0.80 mf

The differential equations of equilibrium of a thin, homogeneous, isotropic, elastic shell of revolution subjected to axisymmetric thermal loading are established. In particular, the results are specialized to the case of a parabolic shell. An approximate solution of these equations is found by the method of asymptotic integration. As an illustrative example, the stresses and rotation are computed for the case of a parabolic shell with an attached edge ring, subjected to a thermal gradient through the thickness of the shell. Author

N64-13307 Goodyear Aerospace Corp., Akron, Ohio
STUDY OF THE EFFECTS OF MECHANICAL DAMAGE ON THE PERFORMANCE OF FILAMENT-WOUND MOTOR CASES Progress Report No. 4, 1 Oct.-30 Nov. 1963
R. A. Burkley, T. J. Boller, and I. R. Butcher 20 Dec. 1963 21 p
(Contract NOw-63-0449-c(FBM))
(GER11154S/3; AD-426723)

This report discusses the planned fabrication, machine flawing, and testing of 18-in.-diam. filament-wound bottles. The objectives of the program are to study the effects of surface flaws on the performance of Polaris motor cases, to compare the effect of winding sequence on the ability to resist failure from surface flaws, and to determine the reliability of various repair techniques. Author

N64-13325 Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRESSES AND DISPLACEMENTS IN ELASTIC/PLASTIC SHELLS OF REVOLUTION WITH TEMPERATURE DEPENDENT PROPERTIES
Perry Stern Jan. 1963 74 p refs
(LMSC 6-90-62-123)

The shell response to the given loads is considered to be independent of viscous effects; consequently the inelastic behavior is described by plasticity theory. The stress–strain relations and plastic flow rules associated with the von Mises loading function, together with all other equations and assumptions, are presented. A boundary-value problem is formulated in terms of state variables and their rates for elastic–plastic shells with infinitesimal strains. The equations are reduced to two governing differential equations in which the plastic strain rates are retained as implicit functions to be determined as the load history progresses. Since an analytic solution of the problem does not seem possible, a numerical step-by-step solution, which has been programed for the IBM 7090 digital computer, is presented. Author

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